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Bulletin of THE MONTANA STATE COLLEGE OF AGRICULTURE *and* MECHANIC ARTS.

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Fourteenth Annual Catalogue Montana State College of Agriculture and Mechanic Arts 1906-'07

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Bozeman, Montana.

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Withdrawn

Fourteenth Annual Catalogue

Montana State College of Agriculture and Mechanic Arts

1906-1907

Printed in Office of Republican-Courier
Bozeman, Montana

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Calendar

1907.

Second Semester begins..... ..8:30 A. M., Monday, Jan. 28.
Washington's Birthday, a holiday..... Friday, Feb. 22.
School of Agriculture and Practical Mechanics ends Friday, March 29.
Visitor's Day..... Friday, May 10.
Arbor Day..... Tuesday, April 16.
Examinations begin 9:00 A. M., Monday, May 27.
Decoration Day, a holiday..... Thursday, May 30.
Baccalaureate Address..... Sunday, June 2.
Music Recital..... Monday, June 3.
Preparatory Department Graduation Tuesday June 4.
Commencement Day..... Wednesday, June 5.
Registration and Examination for Entrance and Conditions,
Monday and Tuesday..... September 9 and 10.
First Semester begins..... Wednesday, Sept. 11.
School of Agriculture and [illegible] Mechanics begins..Tuesday, Oct. 22.
Thanksgiving Recess begins..... Thursday, Nov. 28.
Winter Vacation begins..... Saturday, Dec. 21.

1908.

Winter Vacation ends..... 8:30 A. M., Tuesday, Jan. 7.
Examinations begin 9:00 A. M., Monday, Jan. 20.
First Semester ends..... Saturday, Jan. 25.
Second Semester begins..... 8:30 A. M., Monday, Jan. 27.
Washington's Birthday, a holiday.....Saturday, Feb. 22.
School of Agriculture and Practical Mechanics ends.....Friday, April 3.
Visitors' Day..... Friday, May 8.
Arbor Day, a holiday..... Tuesday, April 21.
Examinations begin..... Monday, May 25.
Decoration Day, a holiday Saturday, May 30.
Baccalaureate Address..... Sunday, May 31.
Music Recital..... Monday, June 1.
Preparatory Department Graduation.....Tuesday, June 2.
Commencement Day Wednesday, June 3.

Montana State Board of Education

GOVERNOR JOSEPH K. TOOLE, (ex-officio chairman).....Helena.
ATTORNEY GENERAL ALBERT J. GALEN, (ex-officio).....Helena.
STATE SUPT. W. E. HARMON, (ex-officio) Secretary.....Helena.

By Appointment.

O. P. CHISHOLM.....Bozeman.
SIDNEY D. LARGENT.....Great Falls.
(Term expires February 1, 1908.)
G. T. PAUL.....Dillon.
CHARLES N. KESSLER.....Helena.
(Term expires February 1, 1909.)
JOHN M. EVANS.....Missoula.
CHARLES R. LEONARD.....Butte.
(Term expires February 1, 1910.)
O. W. McCONNELL.....Helena.
E. O. BUSENBURG.....Lewistown.
(Term expires February 1, 1911.)
B. T. HATHEWAY, Clerk of Board.....Helena.

Executive Board

In Charge of the College and Experiment Station.

JOHN M. ROBINSON.....Bozeman.
(Term expires February 1, 1908.)
E. B. LAMME.....Bozeman.
(Term expires February 1, 1909.)
E. BROOX MARTIN.....Bozeman.
(Term expires February 1, 1910.)
WALTER S. HARTMAN, President.....Bozeman.
(Term expires February 1, 1911.)
JOHN MAXEY.....Bozeman.
(Term expires February 1, 1911.)
GEORGE COX, Secretary-Treasurer.....Bozeman.

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Faculty

JAMES M. HAMILTON, M. S., (Union Christian College) President
Professor of Philosophy and Economics.

MRS. F. E. MARSHALL,
Professor of Art.

WILLIAM F. BREWER, A. M., (Harvard University.)
Professor of English and Latin.

AARON H. CURRIER, A. M., (Oberlin College.)
Professor of French and German.

MISS LILLA A. HARKINS, M. S., (South Dakota Agr. College.)
Professor of Domestic Science.

ROBERT A. COOLEY, B. S., (Massachusetts Agri. College.)
Professor of Zoology and Entomology.

WILLIAM D. TALLMAN, B. S., (University of Wisconsin.)
Professor of Mathematics.

FREDERICK B. LINFIELD, B. S. A., (Ont. Agr. College.)
Professor of Agriculture.

WILLIAM M. COBLEIGH, A. M., (Columbia University.)
Professor of Physics.

JOSEPH A THALER, E. E., (University of Minnesota.)
Professor of Electrical Engineering.

GEORGE B. COUPER, M. E., (University of Minnesota.)
Professor of Mechanical Engineering.

VICTOR K. CHESNUT, B. S., (University of California.)
Professor of Chemistry and Geology.

E. TAPPAN TANNATT, B. S., (Washington State College.)
Professor of Civil Engineering.

WILLIAM J. ELLIOTT, B. S. A., (Ont. Agr. College.)
Professor of Dairying.

ALFRED ATKINSON, B. S. A., (Iowa State College.)
Professor of Agronomy.

ROY W. FISHER, B. S., (University of Idaho.)
Professor of Horticulture.

R. W. CLARK, B. S. A., (University of Minnesota.)
Professor of Animal Industry.

CHARLES S. DEARBORN, B. S., (Kansas Agr. College.)
Assistant Professor of Mechanical Engineering in charge of Shops.

EDMUND BURKE.
Assistant Professor of Chemistry.

DEAN B. SWINGLE, M. S., (University of Wisconsin.)
Assistant Professor of Botany.

MISS MARY A. CANTWELL.
Principal of Preparatory Dept. and Instructor in English and Mathematics.

MISS HELEN R. BREWER, A. B., (Iowa College.)
Instructor in History and Latin.

MRS MABEL KINNEY HALL, Ph. B., (Oberlin College.)
Instructor in Public Speaking and Modern Languages.

MISS FLORENCE BALLINGER.
Instructor in Sewing.

WYATT W. JONES, S. B., (Harvard University.)
Instructor in Zoology.

ANDREW P. ANDERSON, B. S., (Washington State College.)
Instructor in Civil Engineering.

FRANK W. HAM, M. S., (Montana Agr. College.)
Instructor in Chemistry.

MRS EDNA GAGE,
Assistant in Art.

F. ARTHUR OLIVER, (Toronto Conservatory of Music.)
Head of Music Department and Instructor in Piano.

REGINA BARNES, (Wooster Conservatory.)
Instructor in Piano.

PHYLLIS PAULINE WOLFE, (New Eng. Con. and Internat'l Training Sch.)
Instructor in Vocal Music.

GEORGE W. HEY, Mus. Bac., (Syracuse University.)
Instructor in Violin.

MRS. MARY K. WINTER,
Librarian.

STANDING COMMITTEES OF THE FACULTY.

AGRICULTURE.—Linfield, Atkinson, Cooley, Chesnut, Fisher, Elliott, Clark.

ASSEMBLY.—Mrs. Hall, Mrs. Marshall, Oliver.

ATHLETICS.—Tallman, Currier, Atkinson.

BUILDINGS—Tannatt, Clark, Burke.

COMMENCEMENT—Hamilton, Oliver, Currier, Mrs. Hall, Miss Cantwell, Miss Brewer.

ENGINEERING—Thaler, Couper, Cobleigh, Tannatt, Dearborn.

GENERAL SCIENCE—Cobleigh, Tallman, Brewer, Cooley, Miss Harkins, Chesnut.

LIBRARY—Hamilton, Cobleigh, Thaler.

PUBLICATION—Brewer, Miss Cantwell, Cooley, Couper, Fisher.

SCHEDULE—Tallman, Miss Cantwell, Couper.

STUDENT AID—Chesnut, Miss Harkins, Miss Cantwell, Elliott, Thaler.

STUDENT ORGANIZATIONS—Mrs. Hall, Currier, Brewer, Atkinson, Miss Brewer.

The Agricultural Experiment Station

F. B. LINFIELD, B. S. A., Director.
R. A. COOLEY, B. S., Entomologist.
V. K. CHESNUT, B. Sc., Chemist.
R. W. FISHER, B. S., Horticulturist.
E. TAPPAN TANNATT, B. S., Engineer.
W. J. ELLIOTT, B. S. A., Dairyman.
ALFRED ATKINSON, B. S. A., Agronomist.
ROBERT W. CLARK, B. S. A., Animal Industry.
EDMUND BURKE, Meteorologist and Assistant Chemist.
FRANK HAM, M. S., Assistant Chemist.
DEAN B. SWINGLE, M. S., Assistant Botanist.
J. B. NELSON, Superintendent Dry Farm Work.

In connection with the college, the Montana Agricultural Experiment Station has been established. The object of this station is to further the interests of the agricultural industries of the State of Montana. This is done by conducting researches and experiments which may include the physiology of plants and animals; the diseases to which they are severally subject, with remedies for the same; the chemical composition of useful plants at their various stages of growth; the various subjects connected with irrigation; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soil and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly upon the agricultural industry of Montana as may seem advisable.

The experiment station farm consisting of 230 acres adjoins the college. It is provided with the necessary barns, granaries, tool houses, farm implements, live stock, gardens, greenhouses and orchards.

Sub-stations for experimental work in dry farming are maintained in various parts of the state and are conducted in co-operation with the railroads and United States Department of Agriculture. A sub-station

for experiments in fruit culture will be established in the western part of the state during the present year.

The Montana Experiment Station is supported by the annual appropriations from the federal government under the Hatch and Adams Acts, supplemented by the state.

The station issues during the year a series of bulletins, which put in practical form the results of the experimental work. These are sent, upon request, to any citizen of Montana who will apply for them, and any such may have his name entered upon a mailing list, and receive all bulletins as soon as issued.

Address: Director Experiment Station, Bozeman, Montana.

The College of Agriculture and Mechanic Arts

AIM AND SCOPE.

The purpose of the colleges of agriculture and mechanic arts is chiefly to provide industrial education in agriculture, engineering, household economy, and applied science, for the young men and women of the respective states in which they are located. The scope of the Montana Agricultural College is set forth in the two so-called Morrill Acts of Congress which authorized this class of institutions and supplied in part endowment and funds for maintenance; and in an Act of the Montana Legislature accepting the land and money grants from the national government and guaranteeing the state's portion of the financial support.

The First Morrill Act of Congress of July 2, 1862, making a land grant for the partial endowment of the agricultural and mechanical colleges states that the income from these lands shall be used to maintain colleges "Where the leading object shall be, without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

The Second Morrill Act of Congress, August 30, 1890, making an annual appropriation out of the treasury of the United States for the further support and endowment of these colleges, provides that this fund is "To be applied only to instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural and economic sciences with special reference to their application to the industries of life; and to the facilities for such instruction."

The Act of the Montana legislature, approved February 16, 1893, accepts these grants of lands and money and states that the Montana Agricultural College shall have for its object "Instruction and education in the English language, literature, and mathematics, civil and mechanical engineering, agricultural chemistry, animal and vegetable anatomy and physiology, the veterinary art, entomology, geology and such other natural sciences as may be prescribed by the State Board of Education, political, rural and household economy, agriculture, horticulture, history, bookkeeping and especially the application of science and the mechanical arts to practical agriculture in the field, and irrigation and the use of water for agricultural purposes."

ENDOWMENT.

The Enabling Act, providing for the admission of Montana into the Union, approved February 22, 1889, Sec. 16, grants 90,000 acres of land



MONTANA AGRICULTURAL COLLEGE.

VIEW FROM THE NORTH.



MONTANA AGRICULTURAL COLLEGE.

VIEW FROM THE WEST.

to Montana for the use and support of an agricultural college according to the terms of the Act of Congress, July 2, 1862, and Sec. 17, grants an additional 50,000 for the same purposes and subject to the same conditions and limitations as the other grant. The 140,000 acres of land must be sold at a price not less than $10.00 per acre and the principal, together with all money received from the sale of timber, invested as a permanent endowment. The unsold lands may be leased and the rentals together with the interest on the permanent endowmnt shall be used for the maintenance of the college.

The Act of Congress of August 30, 1890, appropriates $25,000 annually out of the treasury of the United States. By the Nelson billl passed March 4, 1907, this amount is increased annually by $5,000 each year, beginning in 1907, until the total annual appropriation shall reach $50,000, at which figure it shall remain.

Both the Acts of July 2, 1862, and August 30, 1890, contain this clause: "No portion of the funds, nor the interest thereon, shall be applied, directly or indirectly, under any pretense whatever, to the purchase, erection, preservation, or repair of any building, or buildings." The State must appropriate money for the following purposes: Buildings, repairs, furniture, fuel, light, water, insurance, printing, salary of all the employes other than the faculty, and the administrative expenses.

LOCATION.

Bozeman, the county seat of Gallatin county, is on the main line of the Northern Pacific railroad. For convenience, healthfulness and beauty of surroundings, the location is unsurpassed. The college is situated on an elevation which commands a view of one of the most fertile valleys in the world, covered far and wide with grain fields and hemmed in on all sides by lofty mountains.

Bozeman is a city of homes and churches, with a wholesome moral environment. It is a most desirable residence city for families who wish to educate their children. Expenses are moderate and there are all the conveniences of a modern city.

CAMPUS AND FARM.

The grounds and farm contain two hundred and thirty acres. Forty acres in the immediate vicinity of the buildings constitute the campus and recreation grounds, which are in lawn, interspersed with flower beds, shrubbery, trees and driveways. The remainder is used for farming and experimental purposes.

BUILDINGS.

1—**College Hall,** situated in the center of the college campus, is a substantial structure of brick and stone of practically fire proof construc-

tion, having a total length of one hundred and twenty-eight feet and a width of ninety feet. It is three stories high and has a basement, which furnishes quarters for the domestic science department and two class rooms. The first floor contains the library, two offices and three large class rooms. The north half of the second floor is devoted to the art department, the arrangement being such that three large rooms can be thrown together, by sliding doors, for exhibition purposes. The south half of the second floor is used by the department of civil engineering and irrigation, and has two offices, two recitation rooms and a drawing room. The third floor contains the large assembly hall, two draughting rooms and five class and music rooms. The building commands a magnificent view of the Bridger and Gallatin mountains and the whole of the beautiful Gallatin valley. The building is heated with steam and lighted with electricity from the generator in the power house.

2—**The Chemistry and Physics Building** is located west of the College Hall. It is 60 by 100 feet, of pressed brick, and is three stories high including the basement. The basement is occupied by the physics lecture room, the mineralogical and assay laboratory and the museum of geology and mineralogy. In addition to these are rooms for the preparation of samples for analytical work, with crushing and grinding machinery. The main floor is occupied by the office and department library, a lecture room, a preparation room, a small class room, and the experiment station laboratory. The east half of the second story contains the laboratories for physics, and the west half, the qualitative and the quantitative laboratories. The north tower is used for the meteorological observatory, and a fine set of registering instruments is installed in it.

3—**The Shop Building** is a one-story frame structure, 60 by 100 feet, with an annex 36 by 50 feet. It contains a forge room and foundry 27 by 60 feet, a machine shop 44 by 72 feet, an office, a wash room and a tool room. The wood shop is in the annex. Nearby stands a small frame building for the traction engines.

4—**The Engineering Laboratory** is a two-story building, 33 by 55 feet, located east of the shops. The first floor contains the dynamos and motors, two steam engines and the strength of material testing machines. The second story is occupied by the storage battery, photometer and electric light rooms, class room and the office of the professor of electrical engineering.

5—**The Experiment Station Building,** consisting of three stories and a basement, is brick veneered and is situated on the west end of the campus adjoining the experiment farm. The upper two floors are occupied by the biology department. On the top floor is a small lecture room, a museum containing the herbarium and zoological collections, and a small room for work in bacteriology. On the floor below are three labor-

atories for work in botany and zoology, the office of the entomologist and a private room. The first floor is occupied by the director's offices, station library and the class room, laboratory, and office of the horticulturist. The basement is used by the department of agronomy and has the following rooms: Office, class room, store room, soil laboratory, and seed laboratory. Immediately south of this building is an insectary, ten by eighteen feet, used for the study of living insects, and a greenhouse, 36 by 50 feet, for the use of the botany department.

6—**The Power House** is a brick structure, thirty-two by seventy-six feet, centrally located with reference to the principal college buildings. It contains an eighty horse-power tubular boiler, a one hundred and twenty-five horse-power Root water-tube boiler, a sixty horse-power "Imperial" engine, directly connected with a forty K.W. commercial dynamo, and coal storage bins. The engine and generator furnish power for electric lights, the ventilating fans, the shop and laboratory machinery.

7—**The Drill Hall** is a one story frame building, 60 by 100 feet, heated and lighted, and with a good floor for gymnasium work. In the south end are two dressing rooms, each 12 by 28 feet. Along each side is a set of four rows of permanent seats, amphitheater style. The hall furnishes a commodious place for military drill, basket ball and other indoor athletics.

8—**The Cattle Barn** is a two story frame building, 120 by 86 feet, and of fine architectural appearance. On the first floor is the dairy stable, quarters for breeding and young stock, a stock judging room 40 by 40 feet, box stalls, feed bins and offices. The second story is used for storage of hay. All stables have cement floor and iron stalls.

9—**The Dairy Building** is a two story frame structure, 25 by 40 feet, with a one story wing, 20 by 40 feet. On the first floor are the butter and cheese making rooms, store rooms, and offices. In the wing are the boiler and engine room, fuel room and ice house. On the second floor are a milk testing laboratory and a class room.

10—**The Horse Barn,** a two story building west of the experiment station building, provides accomodation for thirteen horses, as well as sufficient room for the storage of a considerable quantity of feed.

11—**The Seed Barn and Granary** is a two story building and affords ample storage room for the field crops on the station farm.

12—**The Piggery consists** of a main building, thirty by thirty-five feet, with two wings, sixteen by fifty feet each. In the main building are the feeding rooms and slaughter room, while the wings provide six pens each, for the hogs.

13—**The Poultry Plant** consists of two buildings. The first is 122 feet long by 16 feet wide. In the center is an office and feed room, under which is the incubator cellar and heating plant. One wing is a brooder

house, the other contains six pens, with yards 100 feet long on either side. The other building is 120 long and contains eight pens with yards.

14—**The Greenhouses** are two wooden framed structures, twenty by forty feet each, one supported on a brick foundation and wall, and the other on a wooden foundation with board walls. These are situated east of the station building.

15—**The Station Heating Plant** is a neat brick structure just west of the station building, which furnishes the steam for the buildings grouped about the station. The department of animal industry has an office and class room in this building.

16—**Agricultural Building.** The Tenth Legislative Assembly appropriated the sum of $80,000 for erecting a new agricultural building, which it is hoped will be ready for occupancy September, 1908. It will be of brick, three stories high, and one floor will be for the use of the domestic science department.

GOVERNMENT.

The State Board of Education has general control and supervision of the college. The immediate direction and control is vested in an Executive Board of five members appointed by the governor.

EXPENSES.

There are no dormitories connected with the college. Students find room and board in private families convenient to the college at from $16.00 to $20.00 per month. A list of approved places with prices and accommodations is kept in the president's office. A committee of students meets all trains on registration days and at other times on request and aids in finding satisfactory locations. The total expenses for the year, for tuition, room, board, books and incidental expenses may be estimated at $200 to $250.

EMPLOYMENT FOR STUDENTS.

A number of students earn a part of their expenses while in college. Students expecting to work their way should come with sufficient money to pay their expenses for one semester unless they have engaged work in advance. The college cannot guarantee employment, but those who are willing to give efficient, faithful service have usually found work.

A few students are employed as janitors and as assistants in the shops, laboratories and barns. Others care for furnaces, horses and cows in the city, work in stores and at various kinds of house work. Calls for young lady students to work for their board are numerous.

Students readily find employment at profitable wages during the

summer vacation. A large number annually get work with the transportation companies in the Yellowstone National Park as drivers, camp attendants and domestics. Engineering students are placed with the reclamation service, the railroads and the electrical power plants.

A faculty committee aids students to find employment. Those desiring work should write, stating experience and kind of work desired.

FEES.

1.—Annual matriculation fee for College, Preparatory, Art and One Year Domestic Science Courses $12.00

2.—Annual matriculation fee for School of Agriculture, Steam Engineering and Water Commissioner Courses 6.00

3.—Annual matriculation fee for Four Weeks Course in Dairying and Agriculture 2.00

DEPOSITS.

Agriculture, dairying, soil physics or soil fertility, per semester	$ 2.00
Art, preparatory or college courses, per semester	1.00
China painting, per semester	5.00
Botany, preparatory or college courses, per semester	1.00
Bacteriology, per semester	4.00
Chemistry, freshman, per year	8.00
Quantitative, organic, physical or mineralogy, per year	10.00
Assaying, per semester	20.00
Domestic Science, preparatory or college, per year	1.50
One year course, per year	3.00
Specials, per year	3.00
Sewing, per year	.50
Engineering, college shop courses, per year	6.00
Preparatory shop courses, per year	3.00
Laboratory, per semester	2.50
Surveying, per year	1 50
Practical Mechanics, per year	4.00
Cement testing, per semester	1.50
Physics, preparatory, per year	1.00
College, per year	2.00
Zoology, college, per semester	1 50
Histology, per semester	4.50

A fee is a fixed charge and no part of the fee is returned to the student. The deposits in most cases are intended to cover the cost of materials and breakage of equipment in the laboratory and any balance of the deposit not required for this purpose is returned to the student at the close of the semester or year.

ADMISSION.

Admission to the freshman class, in any of the college courses must be made : (a) By certificate of graduation from an accredited high school, (b) By examination in the subjects required by the college for entrance, (c) By faculty approval of grades from other than accredited schools.

Candidates for admission to the preparatory department, the one year course in domestic science, the school of agriculture, steam engineering and short agricultural courses, must have completed the work of the eighth grade in the public schools or its equivalent. There are no set requirements for art and music, all being admitted who give evidence of being able to profit by the work.

ENTRANCE REQUIREMENTS.

Twelve units are required for admission to the freshman class in any college course.

On and after September, 1908, fifteen units will be required for admission to the freshman class in any college course. Any one with not less than fourteen units may be admitted conditionally, but the unit of preparatory work which has not been offered must be given preference over college subjects.

One unit represents a year's work of nine months and not less than five, forty-five minute periods, two laboratory, shop or drawing periods being considered equal to one recitation.

The following seven units are required of all applicants:

English	3	Mathematics	3
Physics	1		

The remaining eight units shall be presented from the following list:

English	1	General History	1 or 2
German	2	English History	1
French	2	American History	1
Latin	2, 3 or 4	Freehand Drawing	1
Trigonometry	½	Bookkeeping	1
Biology	1	Stenography	1
Physiology	½	Agriculture	1 or 2
Phys. Geog	½	Mechanical Drawing	1
Chemistry	1	Manual Training	1 or 2
		Domestic Science	1 or 2

REGISTRATION.

Registration and Assignment of Work—All students are registered in the president's office, and each one is then assigned to a member of the faculty, called the class officer. The class officers arrange the studies and it is their duty to advise with the students regarding all questions which

arise in connection with their studies and to investigate complaints of unsatisfactory work. Students should consult with the class officers when in need of assistance or information.

Amount and Regularity of Work—Students under twenty-one years of age will be admitted only to regular courses or to work as nearly regular as their preparation allows, unless on special action of the faculty. Students over twenty-one will be admitted to such work, not less than twelve credits, (allowance being made for music) as the schelule permits and their class officers approve.

Change of Registration—A student desiring to change his studies will present his request to his class officer, who, after consulting all teachers interested, will take such action as he may deem best. Change in registration will be made after four weeks for extraordinary reasons only. Requests for change in registration will not be considered during the last eight weeks of a semester.

A change in course of study is allowed by a vote of the faculty only.

ATTENDANCE.

Attendance—A student tardy or absent from any class will present the reason for the tardiness or absence at the first appearance at such class after the tardiness or absence occurred. The teacher will be the judge of the sufficiency of the excuse. A student absent from class the third consecutive time will be reported to the class officer and the president. A student who has been three times tardy or absent and is unable to present a satisfactory excuse is immediately suspended and will be reinstated only by vote of the faculty.

Leave of Absence—When it is necessary for a student to be absent from the city for a day or more, application must be made to the president for leave of absence. A leave of absence is a justification for absence from class but does not give relief from the work omitted.

GRADES.

Passing Grades—An average standing from 90 to 100 is A, from 80 to 90 is B, from 70 to 80 is C, from 60 to 70 is D.

All students, one-half of whose work shall have received the grade of A, will be recommended for the degree "With Honors."

Conditions and Failures—An average standing of less than fifty per cent for any semester's work shall be termed a "failure," and the work must be made up by repeating the subject the following year. An average standing for the semester of more than fifty per cent and less than sixty per cent shall be termed a "condition." A condition must be removed by a special examination before the beginning of the semester in which the subject is next taught. If not removed within this limit the

condition shall become a failure, to be made up by immediately repeating the subject. Examinations for removing conditions shall be held on the Monday and Tuesday preceding the beginning of the college year, and on the last Friday and Saturday of each semester, and at no other time. Laboratory work falling below the grade in quality or quantity shall be marked deficient and shall be made up within the same time limit as conditions.

Students whose work is unsatisfactory will be reported to the class officer and the president and information will be sent to the parents or guardians.

Credits—For convenience in estimating the requirements for a degree, the following rules are laid down: One hour a week for a semester of recitation or lecture work, or two and one-half hours a week for a semester of laboratory, shop, library work, or drawing, shall count as one credit.

If for any reason the full time is not occupied in the shop, laboratory, drawing room, or library, the remainder shall be used under the supervision of the instructor for outside work.

No regular student may take in any one semester work amounting to less than twelve credits, nor more than nineteen, unless a greater number are prescribed in the course.

GRADUATION AND DEGREES.

Bachelor's Degree—Candidates for the bachelor's degree must complete satisfactorily one of the college courses as outlined and not less than 130 credits; and including also a thesis, the value of which in credits shall be determined by the instructor concerned. Students who are relieved for any reason of the requirements in military drill shall present four additional credits in some other subjects.

The degree of Bachelor of Science is conferred upon those completing the work prescribed in the courses in (1) Biology, (2) Chemistry, (3) Domestic Science, (5) Mathematics-Physics, (4) Literature-History.

The degree of Bachelor of Scientific Agriculture is conferred upon those completing the work required in the courses is (1) Agronomy, (2) Animal Industry, (3) Dairying, (4) Horticulture, and Forestry.

The degrees of Bachelor of Civil Engineering, Electrical Engineering, and Mechanical Engineering, respectively, are conferred upon those completing the work required in the courses in (1) Civil Engineering, (2) Electrical Engineering, (3) Mechanical Engineering.

Advanced Degrees—On the completion of one year of post graduate work or three years of professional work, and the presentation of an acceptable thesis, the college will confer upon its holders of bachelor's degrees in their respective courses, the degrees of Master of Science,



DOMESTIC SCIENCE DINING ROOM.



DOMESTIC SCIENCE KITCHEN.

Master of Scientific Agriculture, Mechanical Engineer, Electrical Engineer and Civil Engineer.

MISCELLANEOUS.

Government—Students are expected to conduct themselves as ladies and gentlemen; those who fail to comply with this demand will be requested to leave the institution.

Work for Exhibition—It is required that students who have done work suitable for exhibition purposes shall place such work at the disposal of the institution for the period of two years.

Assembly—Students are required to attend the weekly assembly, at which lectures are delivered by members of the faculty and others.

Student Organizations—All public performances given by students or student organizations, using the name of the college, will be under the supervision of the committee on student organizations.

Military Drill—All male students, except aliens, those physically disqualified, members of the junior and senior classes, and student assistants, are required to take military drill, satisfactory work being requisite for graduation.

Honorable Dismissal—Students intending to sever their connection with the institution, either indefinitely or permanently, should report as soon as possible to the president, either in person or in writing, giving proper explanation, and should apply for an honorable dismissal. Students leaving the institution without such honorable dismissal (except at the end of the college year) will not be re-admitted to the college at any later time, nor will any reports or grades in credit for work done here be sent out until satisfactory explanation is made.

ACCREDITED HIGH SCHOOLS.

Following is the list of accredited high schools of the state:

(1) **City High Schools.**—Anaconda, Billings, Butte, Chinook, Columbus, Forsyth, Fort Benton, Great Falls, Hamilton, Helena and Virginia City.

(2) **County High Schools**—Beaverhead, Dillon; Broadwater, Townsend; Carbon, Red Lodge; Custer, Miles City; Dawson, Glendive; Fergus, Lewistown; Flathead, Kalispell; Gallatin, Bozeman; Granite, Phillipsburg; Jefferson, Boulder; Missoula, Missoula; Park, Livingston; Powell, Deer Lodge; Sweet Grass, Big Timber; Teton, Choteau.

Stevensville Training School.

COLLEGE ORGANIZATIONS.

Young Men's Christian Association—The association is undenominational and is well fitted to promote the moral and religious life of stu-

dents. It conducts mission and Bible study courses, prayer meetings, and secures addresses by religious workers. The association promotes good fellowship by giving social entertainments, assists new students to get started in college life and aids in securing employment for those who wish to work their way through college.

Young Women's Christian Association—The object of this association is the all round development of Christian womanhood. It co-operates with the Y. M. C. A. in its social and religious work among the students. It conducts devotional meetings and carries on systematic Bible study. Several delegates are sent to the Northwestern Conference each year and an active interest is maintained in the state association.

Both associations have neatly furnished rooms in which to hold meetings and transact business.

Literary Societies—Three literary societies are maintained, the Arena for young men, the Hamiltonia for college young ladies and the Philomathion for preparatory students. Each society is in a flourishing condition, holding regular meetings. They give most excellent opportunity for practice in composition, declamation, oratory, debate and music.

Oratorical Association—This organiation has charge of all declamatory, oratorical and debating contests, both between classes in the college and with the institutions which are comprised in the State Oratorical Association. All students are members of this asociation.

Engineering Society—This society admits as active members, all students in the regular college courses in engineering and as associate members, students taking any engineering studies. The object is to increase interest in technical education by discussing the current questions and problems of the profession, and to aid its members financially by purchasing at wholesale rates, books, materials and instruments.

College Choristers—This glee club of twenty voices has attained a high degree of skill in rendering popular and high class music. The annual concert is one of the chief events of the college year. Professor F. Arthur Oliver is the conductor. A splendid opportunity is given students to cultivate their musical talent.

The Exponent—A monthly publication, in magazine form, under this name is maintained throughout the college year entirely under student supervision and control. The editor-in-chief is elected annually by the student body. He appoints the staff from among those students who have taken interest in the paper and been its best contributors. The Exponent is the organ of the students and contains literary, society, local, exchange and athletic departments.

Athletic Association—This association has general control of all athletic interests of the college, subject to the approval of the faculty. Baseball, basket ball, track and tennis are maintained. A part of the annual matriculation fee is appropriated to athletics and all students thus

become members of this association without additional cost.

Agricultural Society—All agricultural students are eligible to membership in this society. Regular meetings are held for the discussion of topics of interest to students in agriculture. The aim is to create a professional interest in scientific agriculture with special reference to the possibilities of farm life.

Domestic Science Club—The students in domestic science maintain a club. Subjects of interest to the housekeeper are discussed.

PRIZES.

Chisholm Prize in Oratory—An annual prize of twenty dollars was founded several years ago by the Hon. O. P. Chisholm, a member of the State Board of Education, for the winner in the annual local oratorical contest. This is open to all students.

Armstrong Prize in Declamation—Hon. F. K. Armstrong, of Bozeman, gives a prize of ten dollars for the winner of the annual declamatory contest of the preparatory school. There is also a second prize of five dollars. Only regular students are eligible.

J. W. Pace Stock Judging Cup—J. W. Pace, of Helena, gives a cup to the winner in the students' stock judging contest, which is open to all agricultural students.

Zenoleum Medal—The Zenoleum Company gives a medal to the winner in the local stock judging contest.

Edison Medal—Seniors in electrical engineering are eligible to compete for the Edison medal. This medal was established at the twenty-fifth anniversary of the incandescent lamp and is awarded annually by the American Institute of Electrical Engineers. Competition is open to students of colleges of engineering of recognized standing.

SCHOLARSHIPS.

The State Board of Education has established a four year scholarship in each of the accredited high schools for the student who receives the highest average grade in his class. These scholarships are awarded each year by the high school principals for their respective schools. The scholarship excuses the holder from paying any tuition or deposits. Any one winning a scholarship may choose any of the state institutions.

MILITARY DRILL.

The Act of Congress, July 2, 1862, makes military drill a requirement in all land grant colleges. The United States government details a regular army officer to each institution and furnishes the necessary equipment of guns and ammunition.

Military drill is required of all male students except members of the junior and senior classes and those physically disqualified. All students taking drill are required to purchase the prescribed uniform. The cost of the uniform, including cap, is from $13.00 to $17.00, according to the quality of the cloth.

The uniforms are ordered by the college after the students register. Those expecting to take military drill should take this into consideration when purchasing clothing.

The names of the three cadets in the graduating class who have the highest grade of merit are reported to the war department for insertion in the U. S. Army Register. In making appointments from civil life to the regular or volunteer army, preference is given to those who have their names so recorded.

LIBRARY AND READING ROOM.

These are two large and well lighted rooms on the first floor of College Hall. The library contains 8638 well selected books, not counting public documents, and about 6,000 pamphlets. Its shelves are well supplied with standard works in technology, history, science and literature. About twelve hundred dollars is spent yearly on books and magazines. The following periodicals are to be found in the reading room:

American Blacksmith; American Chemical Journal; American Historical Review; American Homes and Gardens; American Journal of Mathematics; American Journal of Pharmacy; American Journal of Science; American Machinist; American Veterinary Review; Analyst; Anatomischer Anzeiger; Annals of Botany; Annals of Mathematics; Atlantic Monthly; Annals American Society of Political Science; Berichte der Deutschen Chemischen Gesellschaft;Bio-chemische Centralblatt; Bon Ton; Boston Cooking School Magazine; Botannical Gazette; Botanisches Centralblatt; Breeders' Gazette; British Gardening; Bulletin of the Torrey Botany Club; Canadian Entomologist; Cassier's Magaine; Cement Age; Chemical Engineer; Century Magazine; Chemical News; Chicago Dairy Produce; Cosmopolitan; Country Gentleman; Country Life; Delineator, The Dial; Dietetic and Hygienic Gazette; Die Elektrotechnische Zeitung; Economic Geologist; Education; Educational Review; Electrical World and Engineer; Electrician (London); Electrical Railway Review; Engineering Magazine; Engineering News; Engineering Record; Engineering Review; Engineering Contracting; Entomological News; Entomological Monthly Magazine; Fliengende Blaetter; Forestry and Irrigation; Forum; Gardener's Chronicle; Good Housekeeping; Harper's Bazar; Harper's Magazine; Harper's Weekly; Hoard's Dairyman; Home Companion; Illustration; Intercollegian; Iowa Homestead; Irrigation Age; Journal of the Institute of the Electrical Engineers; Journal of New York Entomological

Society; Keramic Studio; L'Art de la Mode; Ladies' Home Journal; Library Index; Library Journal; Literary Digest; London Live Stock Journal; Machinery; McClure's Magazine; Modern Housekeeping; Modern Language Notes; Modern Priscilla; National Geographic Magazine; New York Produce Review; The Nineteenth Century; The North American Review; Orange Judd Farmer; Outing; Outlook; Philosophical Magazine, British; Physical Review; Popular Science Monthly; Power; Psyche; Putnam's Monthly; Railway and Locomotive Engineering; Records of the Past; Reliable Poultry Journal; Review of Reviews; Saturday Evening Post; Sanitary Engineering; School Science and Mathematics; Science; Science Abstracts, Secs. A and B; Scribner's; Sibley Journal of Engineering; Speaker; Success; Table Talk; Talent; Technical World; Ueber Land und Meer; Western Electrician; What to Eat; Woodcraft; World's Work; Youth's Companion; Zeitschrift fur Analytische Chemie; Zoological Record; Zoologische Anzeiger.

The following periodicals are donated:

Bulletin of the Bureau of Labor; Climate and Crop Service, Mont. Sec.; Department of Labor; Experiment Station Record; Farmer; Farm and Voice; Industrialist; Indiana Farmer; Monthly Weather Review; National Stockman and Farmer; Northwest Agriculturist; Patent Office Gazette; School of Mines Quarterly.

The following newspapers are also to be found in the reading room. Most of them are donated:

Anaconda Standard; Basin Progress; Belt Valley Times; Big Timber Pioneer; Bozeman Chronicle; Butte Evening News; Dillon Tribune; Farm and Floral World; Farmers' Voice; Fergus County Argus; Forsyth Times; Great Falls Leader; Inland Empire; Inter Lake; Kendall Miner; Madisonian; Montana Daily Record; Montana Homestead; Montana Sunlight; Pacific Homestead; Phillipsburg Mail; Red Lodge Picket; Republican-Courier; Rocky Mountain Husbandman; Salt Lake Tribune; Townsend Star; The Times; Tri-County News; Western News.

Organization of Instruction

A. The folowing four year college courses, each leading to the appropriate bachelor's degrees, are offered:

1.—Division of Agriculture.

1, Agronomy; 2, Animal Industry; 3, Dairying; 4, Horticulture and Forestry.

2. Division of Engineering.

1, Civil Engineering; 2, Electrical Engineering; 3, Mechanical Engineering.

3. Division of Science.

1, Biology; 2, Chemistry; 3, Domestic Science; 4, History-Literature; 5, Mathematics-Physics.

B. The following courses, not leading to a bachelor's degree, are offered:

1.—Preparatory School.

1, Academic; 2, Manual Training; 3, Domestic Science.

2. School of Agriculture.
3. School of Pharmacy.
4. Art School.
5. Music School.

C. The following special courses are offered.

1. Domestic Science.
2. Steam Engineering.
3. Water Commissioner.
4. Agriculture.
5. Dairying.

Division of Agriculture

Four year college courses are maintained in (1) Agronomy, (2) Animal Industry, (3) Dairying, (4) Horticulture and Forestry. The aim is to give a scientific and practical training for the agriculturist, the horticulturist, the dairyman, the stockman and the forester. The work is the same for the first two years with the exception of forestry. At the end of the sophomore year the student chooses the group which he desires to make his specialty. The courses in agronomy, animal industry, dairying and horticulture lead to the degree of Bachelor of Scientific Agriculture. The course in forestry leads to the degree of Bachelor of Science.

AGRICULTURE COURSES.

FRESHMAN YEAR.

English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Inorganic Chemistry (Chem. 1 and 2)	4	Inorganic Chemistry (Chem. 1 and 2)	4
French or German	4	French or German	4
Farm Dairying (Dairy 1)	4	General Botany (Biol. 9)	5
Trig. and Logarithms (Math. 2)	3	Mineralogy (Geol. 3)	2
Animal Types (An. Ind. 1)	3	Breeds of Livestock (An. Ind. 2)	3
Drill	1	Drill	1
	21		21

SOPHOMORE YEAR.

		English Literature (Eng. 10)	2
English Literature (Eng. 10)	2	Organic Chemistry (Chem. 10)	3
Organic Chemistry (Chem. 10)	3	Verterbrate Zoology (Biol. 2)	4
Invertebrate Zoology (Biol. 1)	5	Field Crops (Agron. 2)	3
Crop Production (Agron. 1)	3	Plant Physiology and Histology (Biol. 10)	4
Gen. Des. Physics (Phys. 1a)	3	General Forestry (For. 2)	3
Prin. of Horticulture (Hort. 1)	3	Drill	1
Drill	1		
	20		20

Course in Agronomy

Agronomy is the science of the field and its crops. It treats of the production and improvement of field crops, the cultivation of soils and the maintenance of their fertility; and general farm management, which is the application of economic business methods to farm practices.

Because of the peculiar agricultural conditions existing in western states, a new agriculture has to be developed. The handling of dry farming lands is necessary only in the west. The problems which have to do with irrigation water, and the cultivation of the soil and management of the crops under irrigation must be solved by western investigators and agriculturists. It is to fit men to deal with these and other questions of production on the farm that this course is offered.

The first two years of the agronomy course are devoted to the study of the natural sciences, languages, and some general agricultural work. This places the student in a position to appreciate and intelligently discuss the methods of practice taken up later in the course.

The last two years of the course are designed to give the student clear insight into methods for the cultivation and maintenance of the fertility of the soil; the peculiarities of the growth and handling of different crops; the arrangement, the laying out of the farm, and the principles which govern successful farm management.

With a constantly growing appreciation of the value of the agricultural lands of the west, comes an active demand for young men trained along the lines of practical and scientific agronomy, men who combine college training with practical experience and native ability. Such training is offered to young men in this course. The demand for such students is unlimited, at a compensation not exceeded in any other calling. A few of the many lines open to graduates of this department are: College and experiment station work, agricultural journalism, managers of large irrigated and dry farms, managers and salesmen for seed firms, and superintendents for companies with large land holdings.

COLLEGE HALL AND CHEMISTRY BUILDING.



COLLEGE HALL.

AGRONOMY COURSE.

JUNIOR YEAR.

Expository Composition (Eng. 2)	2		
Soil Physics (Agron. 3)	5	Expository Composition (Eng. 2)	2
Plane Surveying (C.E. 1a)	2	Soil Fertility (Agron. 5)	3
Field Practice (C. E. 1)	2	Plant Pathology (Biol. 11)	4
History of Agricul. (Agron. 4)	3	Feeding Livestock (An. Ind. 4)	4
Judging of Livestock (An. Ind.3)	1	Agricultural Mech. (C.E. 7)	3
Bacteriology (Biol. 12)	4	Elective	3
	19		19

SENIOR YEAR.

Farm Management (Agron. 6)	3		
Economics (3)	2	Economic Entomology (Biol. 5)	4
Improvement of Field Crops (Agron. 7)	4	Economics (3)	2
Irrig. and Drainage (C.E. 10)	3	Farm Sanitation (Vet. Sci. 5)	3
Thesis (Agron. 9)	2	Field Experimentation (Agron. 8)	3
Elective	5	Thesis (Agron. 9)	2
		Elective	5
	19		19

Course in Animal Industry

The course in animal industry consists of study in judging, feeding, breeding and caring for farm animals. Among the positions it prepares for are: Agricultural college and experiment station work, federal government work, farmers' institute work, buyers and salesmen of live stock, teachers of animal industry in high schools and managers of live stock farms. The demand from these sources for men trained in the science and practice of animal industry is in excess of the supply.

The first two years of the course are given largely to a study of basic subjects as English, modern language, mathematics, physics, chemistry, botany and mineralogy. The last two years are given to special practical and theoretical work in judging and feeding live stock, veterinary science, bacteriology and other allied subjects.

This course is given through text books, lectures, practice and observation. Lectures are given by specialists and the student is made familiar with the most modern ideas and acquainted with the methods of the most successful breeders and feeders in this and European countries. The work in judging is given by the use of college animals and stereopticon lectures. To secure a variety of animals, excursions are made to stock farms near the college. Advantage is also taken of the live stock on exhibition at the state and inter-state fairs. Practical instruction is also given in compounding rations, making out pedigrees and keeping breeding records. The practical and theoretical are carefully blended.

ANIMAL INDUSTRY COURSE.

JUNIOR YEAR.

Judging Livestock (An. Ind. 3)	1	Judging Livestock (An. Ind. 3)	1
Bacteriology (Biol. 12)	4	Feeding Livestock (An. Ind. 4)	4
Milk and Milk testing (Dairy 2)	4	Anatomy (Vet. Sci. 1)	3
Soil Physics (Agron. 3)	5	Soil Fertility (Agron 5)	3
Poultry (An. Ind. 10)	3	Animal Physiology and Histology (Biol. 3)	4
Expository Composition (Eng. 2)	2	Agricultural Mechanics (C.E. 7)	3
		Expository Composition (Eng. 2)	2
	19		20

SENIOR YEAR.

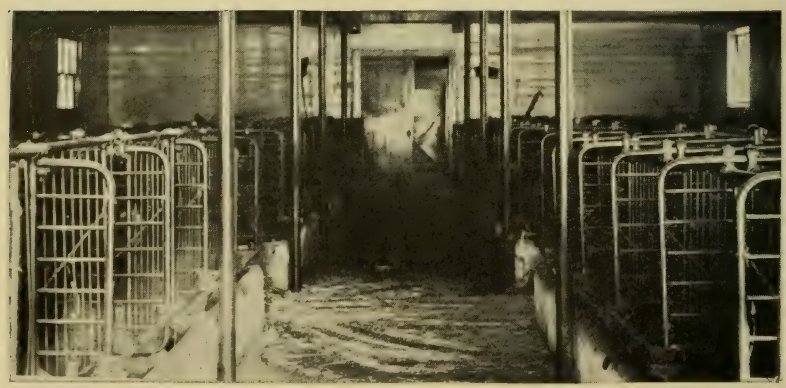
Principles of Breed'g (An. Ind. 5)	3	Advanced Stock Judging (An. Ind. 7)	2
Herd Books & Pedigrees (An. Ind. 6)	1	Care and Management of Livestock (An. Ind. 8)	3
Pathology (Vet. Sci. 3)	3	Parisitology (Vet. Sci. 8)	3
Farm Management (Agron. 6)	3	Farm Sanitation (Vet. Sci. 5)	3
Thesis (An. Ind. 11)	2	Methods of Livestock Experimentation (An. Ind. 9)	2
Elective	7	Thesis (An. Ind. 11)	2
		Elective	4
	19		19

Course in Dairying

The college course in dairying covers a period of four years and offers a thorough training in this particular branch of agricultural work.

The chief object of the course is to turn out scientifically trained men to fill positions in the numerous fields that are open along dairy lines. The college has calls for men to act as assistants and professors at various agricultural colleges and experiment stations; to fill positions as inspectors of creameries and dairies in the development of the state's dairy resources; to accept positions with the U. S. Civil Service Commission as experts and specialists in the various branches of dairy husbandry; for managers of dairy corporations, and community milk depots; to become managers of large dairy farms; and last, to turn out men with a scientific, as well as a practical knowledge, with which to operate their own farms in Montana.

It is the intention to give not only the scientific side of a dairy education but also actual work in the college creamery and cheese factory.



Interior View of Dairy Barn.

DAIRY COURSE.

JUNIOR YEAR.

Milk and Milk Testing (Dairy 2)	2	Advanced Butter Making (Dairy 3)	3
Bacteriology (Biol. 12)	4	Feeding Livestock (An. Ind. 4)	4
Judging Stock (An. Ind. 3)	1	Animal Physiology and Histology (Biol. 3)	4
Poultry (An. Ind. 10)	3	Anatomy (Vet Sci. 1)	3
Soil Physics (Agron. 3)	5	Agricultural Mechanics (C.E. 7)	3
Expository Composition (Eng. 2)	2	Judging Livestock (An. Ind. 3)	1
		Expository Composition (Eng. 2)	2
	19		20

SENIOR YEAR.

Dairy Bacteriology (Dairy 4)	4		
Scoring Butter and Cheese (Dairy 6)	1	Factory Management (Dairy 7)	3
Principles of Breeding (An. Ind. 5)	3	Cheese Making (Dairy 5)	2
Pathology (Vet. Sci. 3)	3	Obstetrics (Vet. Sci. 7)	3
Farm Management (Agron. 6)	3	Care and Management of Livestock (An. Ind. 8)	3
Thesis (Dairy 8)	2	Farm Sanitation (Vet. Sci. 5)	3
Elective	3	Thesis (Dairy 8)	2
		Elective	3
	19		19

Horticulture and Forestry

The four years' course in horticulture, leading to the degree of Bachelor of Scientific Agriculture in horticulture, is designed to prepare students as teachers in agricultural colleges, investigators, in the agricultural experiment stations, editors of horticultural papers, managers of fruit associations, and superintendents of commercial orchards and fruit plantations. The West leads the world in methods of orcharding and disposing of orchard products, and there is a strong and growing demand for persons properly trained to manage the orchard projects now operated throughout the fruit regions of the West. Fruit growing, when done in a scientific way, is extremely profitable and presents an inviting field for the trained horticulturist. The college offers good facilities for a thorough training in all branches of horticulture.

A four years course in forestry, leading to the degree of Bachelor of Science in forestry, offers instruction in the art and science of forestry and provides facilities for the education of students who desire to enter the United States Forest Service or to those who intend to become managers of large forest areas or teachers of forestry in colleges and universities. The very extensive area of the western states now within forest reserves and the still larger area of timber lands owned by individuals and companies will require the services of a large number of men who are trained along the lines of scientific forestry. The college is situated within a few miles of a large forest reserve, where forest conditions can be studied at first hand. Within this forest reserve are several saw mills, and an extensive area is being lumbered under direction of the United States Forest Service. Excellent facilities for studying the methods of conservative lumbering are thereby afforded students of forestry.

HORTICULTURE AND FORESTRY COURSE.

FRESHMAN YEAR.

English Composition (Eng. 1)	2		
Inorganic Chemistry (Chem 1 and 2)	4	English Composition (Eng. 1)	2
Trigonometry (Math. 2)	3	Inorganic Chemistry (Chem. 1 and 2)	4
French or German	4	General Botany (Biol 9)	5
Animal Types (An. Ind. 1)	3	Mineralogy (Geol. 3)	2
* or Mechanical Drawing (M.E. 11)	3	French or German	4
Farm Dairying (Dairy 1)	4	Breeds of Livestock (An. Ind. 2)	3
* Forest Policy (For. 1)	2	* or Meteorology (Geol. 1)	3
Drill	1	Drill	1
	20		21

SOPHOMORE YEAR.

English Literature (Eng. 10)	2	English Lit. (Eng. 10)	2
Gen. Descriptive Physics (Phys. 1a)	3	Plant Physiology and Histology (Biol. 10)	4
Invertebrate Zoology (Biol. 1a)	5	General Forestry (For. 2)	3
Principles of Horticulture (Hort. 1)	3	Field Crops (Agron. 2)	3
Crop Production (Agron. 1)	3	* or French or German	3
* or Plane Surveying (C.E. 1)	2	Organic Chemistry (Chem. 10)	3
* Field Practice (C. E. 1a)	2	* or Landscape Horticulture (Hort. 8)	3
Organic Chemistry (Chem. 10)	3	Vertebrate Zoology (Biol. 2)	4
* or French or German	3	* or Plant Pathology (Biol. 11)	4
	19 or 20		19

HORTICULTURE AND FORESTRY COURSE.

JUNIOR YEAR.

Soil Physics (Agron. 3)	5	Economic Entomology (Biol. 5)	4
Bacteriology (Biol 12)	4	Soil Fertility (Agron. 5)	3
Nursery Practice (Hort. 3)	3	Expository Composition (Eng. 2)	2
Pomology (Hort. 2)	3	* or Forestry-History (For. 5)	2
* or Silviculture (For. 3)	3	Principles of Vegetable Gardening (Hort. 4)	3
Expository Composition (Eng. 2)	2	* or Forest Protection (For. 4)	3
* or Forest Botany (Biol. 13)	3	Plant Pathology (Biol. 11)	4
Plane Surveying (C. E.1)	2	* or Forest Laws (For. 6)	2
Field Practice (C. E. 1a)	2	* Political Science	2
* or Geology (Geol. 1)	2	Elective	3
	20 or 21		19

SENIOR YEAR.

Economics (3)	2	Economics (3)	2
Farm Management (Agron. 6)	3	Plant Breeding (Hort. 7)	4
* or Forest Mensuration (For. 7)	3	* or Forest Economics (For. 9)	4
Evolution of Cultivated Plants (Hort. 5)	3	Landscape Horticulture (Hort.8)	3
* or Forest Technology (Biol. 14)	3	* or Lumbering (For. 8)	3
Drainage and Irrigation (C.E. 10)	3	Review of Horticultural Literature (Hort. 9)	2
* or Lumbering (For. 8)	4	* or Forest Mensuration (For. 7)	3
** Greenhouse Construction and Management (Hort. 6)	3	Small Fruit Culture (Hort. 10)	3
Thesis (Hort. 11 or For. 10)	2	* or Forest Entomology (Biol.)	2
Elective	3 or 5	Thesis (Hort. 11 or For. 10)	2
	19	Elective	3
			19

Note—*Subjects not required of students in horticultural courses.
** Subjects not required of students in forestry.



DAIRY BUILDING.



COLLEGE BARN.

Agronomy

PROF. ATKINSON.

One entire floor of the experiment station building is devoted to agronomy instruction work and is divided into soil and grain laboratories and class rooms.

The soil laboratory will accommodate thirty students, and is fitted with the most modern apparatus for demonstrating the movements and methods for the control of heat, air and moisture in relation to the soil. At the beginning of the semester each student is given the equipment necessary in the term's work. This permits of independent and continuous work, as lockers are provided so that the apparatus is always at hand.

For the study and comparison of the different classes and grades of grain, a laboratory, accommodating twenty-four students, has been fitted out. During the summer sheaf samples of all grains, grasses, etc., are collected and stored for study. Samples of the grain standards as recognized by the different markets are kept so that the students may gain a clear idea of the relative merits of the grains judged in the class work.

Score cards based on Montana conditions have been prepared for wheat, oats, barley, corn, and are used to impress the students with the points to be looked for in grain judging work.



Laboratory of Soil Physics.

(1) Crop Production.—Reproduction, germination and growth. Vitality and germination of seeds with circumstances influencing these; con-

ditions of plant growth, peculiarities of the different agricultural plants in respect to structure, habits and requirements for successful growth. I, 3.

(2) **Field Crops.**—A study of the crops of the farm, grain crops, forage crops, root crops, sugar and fiber crops; their history and distribution over the earth, methods of culture, cost of production, consumption of products and residues or by-products. In this course considerable time is spent in score card practice in the grain judging laboratory. II, 3.

(3) **Soil Physics.**—This course is designed to prepare the students to better understand the effects of the different methods of treatment of soils, and the influence of these upon moisture, texture aeration fertility and production. It comprises a review of the origin, formation and classification of soils and a study of the conditions influencing the supply of heat, air and moisture as related to growing plants. The work of the class room is supplemented by laboratory work comprising the determination of such questions as the water holding capacity and capillary power of various soils; the effect of mulches and of various systems of rotations on the physical condition of the soil. I, 5.

(4) **History of Agriculture.**—A study of the development of agriculture from the dawn of civilization, considering farming as carried on by the Greeks and Romans; through the middle ages; feudal farming and the dawn of modern methods and practices in agriculture. I, 3.

(5) **Soil Fertility.**—Maintenance of fertility, fertilizers and rotation. The influence of barn yard manure, green manuring and commercial fertilizers upon the quality and yield of the various crops. The effects of different crops upon the fertility of the soil and upon succeeding crops; different rotations and the ultimate effect of different methods of farm management upon the fertility and productive capacity of the soil; also a study of the preservation of barn yard manure. II, 4.

(6) **Farm Management.**—This course considers the problems of farm management and the relative profits of different systems of farm management; the relation of the industry of agriculture to other industries, and the social conditions of agriculture are considered. I,3.

(7) **Improvement of Field Crops.**—This course includes a study of the principles that underlie the development and breeding of field crops. I, 4.

(8) **Field Experimentation.**—This course comprises a study of the methods of presenting the results of field experiments; also a study of the plans and methods used in crop experimentation, with methods for keeping records. II, 3.

(9) **Thesis.**—Agronomy students are required to prepare a graduating thesis on some subject to be approved by the head of the agronomy department. The subject of this thesis must be decided on not later than November 15th, of the senior year, and must include considerable research and experimental work on the part of the student. I and II, 2.

Animal Industry

PROF. CLARK.

For the work in animal industry there is available a herd of twenty-five dairy cows, a small herd of pure bred cattle, Herefords, Shorthorns Holsteins and Jerseys, Percheron and the farm horses, some pure bred hogs, Berkshire, Poland China and Yorkshire. During the winter season the live stock used in the feeding experiments is also available for study. For the poultry work eight breeds of fowls are kept.

The cattle barn is a two-story frame building with two wings extending to the south. One of these wings is used for the dairy cows and breeding stock, and the other for bulls, young stock and calves. Between these two rooms is located a stock judging room forty feet square. The second story of the main barn is used for the storage of hay. The first story provides feeding rooms, storage for grain and box stalls.

The piggery consists of a main building thirty by thirty-five feet, with two wings sixteen by fifty feet each. In the main building are the feeding rooms and slaughter room, while the wings provide six pens each, or twelve pens altogether, for the hogs.

The poultry buildings include two main buildings, one seventy-two by sixteen feet, with twelve pens; the other one hundred and twenty-eight feet long, with eight pens; with yards one hundred feet long on either side, and a brooder house, thirty-six by sixteen feet. These buildings are connected by a feed room, fourteen by twenty feet, under which is an incubator cellar and a heating plant for the building. They are south of the experiment station building.

The Tenth Legislative Assembly made an appropriation of $5,000 for the purchase of live stock for the college. This will be used to enlarge the herds of pure bred cattle and to secure horses and a small flock each of a few of the best sheep for Montana.

(1) **Animal Types.**—A study of type as related to production and work. This course covers the judging of the different market classes of cattle, (beef and dairy), of sheep, (mutton and wool), of horses, (light and heavy), and of hogs, (bacon and fat). One half of the time of this course is given to practical handling and judging of the stock in the stock pavillion. I, 3.

(2) **Breeds of Live Stock.**—A study of the development of the breeds of horses, cattle, hogs and sheep will illustrate the principles and particular characteristics that distinguish one breed from another and will show the adaptability of each particular breed to various climates, conditions and purposes. These lectures will be illustrated by stereopticon views of characteristic animals of the different breeds. Lecture 2, Lab. 1. II, 3.

(3) **Judging Live Stock.**—This is a critical study of the different breeds of live stock from a study of living animals. One afternoon a week in stock judging pavillion for the year. I and II, 2.

(4) **Feeding Live Stock.**—The principles underlying the profitable feeding of animals. The composition of plants, animals and animal products. The practict that gives best results as indicated by available data gathered from the work of experiment stations in this and other countries. II, 4.

(5) **Principles of Breeding.**—A study of laws of heredity, of correlation, reversion, variation, selection and methods of grading, crossing, in-and-in-breeding, etc. Application of these laws is illustrated by reference to the practices of noted improvers of animals and plants. The students are shown how these laws may be taken advantage of in improving the live stock of the farm. I, 3.

(6) **Herd Books and Pedigrees.**—This is largely a laboratory study of the herd books of different breeds of live stock. The tabulation of pedigrees and such other exercises as will enable the student to learn the value of a pedigree and show how to keep the record of a breeding herd. I, 1.

(7) **Advanced Stock Judging.**—Animal measurements and the systematic study of animal form, function and performance; the aim being to give exact and intimate acquaintance with the detailed form of specialized types, a knowledge that is essential to the highest success in selection and breeding; also some systematic work in the judging of groups of cattle, horses, sheep and swine, similar to those found at county and state fairs. II, 2.

(8) **Care and Management of Live Stock.**—A special study of the methods to be followed in the breeding, feeding and development of the various classes of live stock as illustrated from the practices of the most successful live stock breeders. II, 3.

(9) **Method of Live Stock Experimentation.**—This is a study of experiment station literature along the lines of live stock experiments to enable the student to get acquainted with the methods pursued in those investigations. II, 2.

(10) **Poultry.**—Breeds and management; poultry houses; feeding and care of poultry; the operation of incubators and brooders. I, 2.

(11) Students specializing in animal industry will be required to prepare a thesis during their senior year based upon some line of original work, to be arranged with the head of the department. I, II, 2.

Veterinary Science

(1) **Anatomy.**—Lectures describing the locomotory apparatus, including bones, articulation and muscles; also careful description of the viscera, blood vessels, nerves and organs of special sense. The horse will be taken as a type. Laboratory dissection. II,3.

(2) **Comparative Anatomy and Physiology.**—A more advanced and thorough consideration of the anatomical construction with special reference to the comparative anatomy and physiology of the horse, ox, sheep and hogs. Laboratory dissection. I,, 3.

(3) **Pathology.**—General pathology, consisting of a brief course in morbid anatomy and histology. Lab. Clinic. I, 3.

(4) **Materia Medica.**—This work will include a consideration of the common remedies used in the treatment of diseases. A few lectures on toxicology and serum therapeutics. Lab. tuberculin testing, mallein testing, vaccination and immunization. II, 3.

(5) **Farm Sanitation.**—A comprehensive course in general sanitaion relating to sources of water, milk and food supplies, sewerage disposal, source and spread of infectious diseases both of man and animals; the prevention and inhibition of infection, decomposition and decay. A study of asepsis, antiseptics, disinfection and disinfectants. II, 3.

(6) **Common Diseases of Farm Animals.**—Etiology, prophylaxis, diagnosis ,treatment and eradication. This course will also include a few lectures on government control and supervision of diseases of livestock. II, 2.

Dairying

PROF. ELLIOTT.

In this department we are thoroughly equipped with all modern appliances for manufacture of butter and cheese. We have 8 different makes of hand separators,so that the student has an excellent opportunity to compare the merits and demerits of each. In churns we have the Simplex and Disbrow, both combined churns and butter workers, yet entirely different in style. In addition there is a model milk room, twin cream ripening vats, tempering vats, starter cans and a Bohn refrigerator, together with all things necessary for the manufacture of butter as it is done in an up-to-date plant.

The creamery is equipped with a 12-horse boiler and 10-horse high speed engine, and in the practical work the students take their turn in the engine room, for the practical experience gained thereby.

One end of the dairy building is used as a cheese room; in this we have cheese vats, gang and upright presses, and all necessary hoops and

equipment for the manufacture of all varieties of American Cheddar cheese. In this department we make both Edam and Brick cheese, but especial emphasis is placed on the manufacture of the American cheese.

The testing laboratory is very thoroughly equipped with four different styles of Babcock testers (both hand and steam) and all necessary glassware for the testing of milk, cream, butter, cheese, skim milk, whey, etc. Especial emphasis is laid upon the testing of milk and its products for adulterations.



Students at Work in the College Creamery.

(1) **Farm Dairying.**—This course will consist of three lectures and three laboratory periods, and will comprise a study of the subject of dairying in its general relation to the farm. The class work takes up production of milk, separation of cream by gravity and separator; the preparation of starters; the ripening and churning of cream; the packing and marketing of butter. The use of the Babcock tester is also discussed with particular reference to its use on the farm; also the construction of the milk house and stables, with regard to sanitary conditions as well as to utility. I, 4.

(2) **Milk and Milk Testing.**—This course will comprise a study of milk, its secretion, composition and uses; pasteurization; separation and handling for city milk trade; the care of milk for creamery or cheese factory; also the testing of variations and adulterations; the testing of butter and cheese; and the use of the acidimeter. Two lectures and 2 laboratory. I, 4.

(3) **Advanced Butter Making.**—This comprises a thorough and detailed study of the physical and chemical properties of milk and its components; of the principles of separation of cream by gravity and centrifugal separators, the effect of the different degrees of acidity of cream upon the quality of the butter, and the principles of churning, packing and marketing of butter. The laboratory periods are devoted to practical work in the creamery, where the student has an opportunity to study all the leading makes of separators and churns, etc. This course gives the student an intimate knowledge of actual creamery conditions; 2 lectures and 1 laboratory. II, 3.

(4) **Dairy Bacteriology.**—This course will comprise a study of the relation of bacterial life to milk and milk products. The question of bacterial infection of milk and methods of prevention; fermentations in milk and their treatment. Disease producing bacteria in milk, preservation of milk with especial reference to pasteurization. The bacteria in fluid products of milk, butter and cheese. 3 lectures and 1 laboratory. I, 4

(5) **Cheese Making.**—The equipment for factory and home cheese-making, the principles and practice necessary to make a uniform article and methods used to overcome characteristic differences are explained and illustrated in the class room and laboratory. All common varieties of cheese, such as Cheddar, Swiss, Brick, Limburger, are discussed, and as far as possible made in the class room, but the Cheddar cheese making is particularly emphasized. II, 2.

(6) **Scoring Butter and Cheese.**—This course is designed to give the student a correct idea of the standard market requirements for dairy products. Butter and cheese are examined and scored by the student and their judgment compared with the instructors. 1 laboratory. I.1.

(7) **Factory Management.**—The location, organization, construction, arrangement, apparatus, the equipment and operation of farmer's co-operative or private enterprise creameries or cheese factories. Methods of paying for milk and cream, and the preparation of plans for home dairy or co-operative factory. II, 3.

(8) **Thesis.**—During the senior year all dairy students are required to prepare a thesis. This must be original work by the student, who should consult with the professor in charge regarding a subject. Two credits will be allowed in the first semester and two in the second for this work. If it is sufficiently meritorious, such thesis may be published.

Horticulture and Forestry

PROF. FISHER.

Among the facilities offered for instructional purposes and practical demonstration in the courses in horticulture and forestry may be mentioned: The orchard containing about 500 trees of hardy varieties of apples, pears, plums and cherries; the small fruit garden containing all the commercial varieties of bush fruits and strawberries; the vegetable garden in which are grown each year different varieties and kinds of vegetables; the nursery containing varieties of fruit trees and shrubs, and a large list of ornamental and forest trees, many plants being propagated in the nursery for the college campus; seed beds in which are grown forest tree seedlings and ornamental plants; hot beds and cold frames are used in plant propagation and culture; two greenhouses, each 20x40 feet, are used for instructional purposes in greenhouse management, plant propagation and manipulation and plant breeding; a collection of horticultural implements for budding, grafting, pruning, etc.; models of apples showing the varieties adapted to Montana and the fungus diseases to which apples are subject; a collection of preserved and natural specimens of fruits and woods; pictures and lantern slides showing different kinds of orchards, and forest conditions; lantern slides showing the structure of different woods; apparatus for measuring trees in the forest, and scaling logs.

The library contains many standard works upon horticulture and forestry.

Horticulture

(1) **Principles of Horticulture.**—This course will deal with the principles underlying the various horticultural operations; variation, selection and crossing of plants with reference to plant improvement. The methods of pruning, cultivation, gathering and marketing of fruits and vegetables are studied along with the principles in each case. I, 3.

(2) **Pomology.**—This course deals with the principles and methods of fruit growing. The methods of propagating fruit trees and shrubs, pruning, cultivating and the general management of fruit plantations are considered. A systematic study of all northwestern fruits is made. I, 3.

(3) **Nursery Practice.**—The methods of collecting, storing and planting tree seeds; growing and caring for seedlings in the seed bed; transplanting and caring for the seedlings in the nursery row; methods of transplanting to permanent places; growing trees from cuttings, layers, sprouts, grafts, buds, etc. This subject is taught by lectures, text books and field work. I, 3.



BOYS' BASKET BALL TEAM.



GIRLS' BASKET BALL TEAM.

(4) **Principles of Vegetable Gardening.**—Lectures and practice; treating of the principles and methods of growing vegetables under glass and in the field, particular attention being given to the vegetables suited to Montana conditions. II, 3.

(5) **Evolution of Cultivated Plants.**—Lectures and text book work on evolution relating to the cultivated horticultural plants. I, 3.

(6) **Greenhouse Construction and Management.**—The construction, heating and maintaining of greenhouses, with lectures and practice treating of the methods of growing plants in greenhouses and conservatories. I, 3.

(7) **Plant Breeding.**—Lectures, text books and practice. This subject deals with the principles and methods of improving plants by cross pollenating, selection, etc. II, 4.

(8) **Landscape Horticulture.**—The laying out and planting of private and public grounds are discussed. The trees, shrubs and flowers suited to Montana conditions are studied. II, 3.

(9) **Review of Horticultural Literature.**—Two hours per week in one semester of the senior year are given in class to the discussion of literature pertaining to horticulture. Experiment station bulletins, current horticultural papers, magazines and books are reviewed. II, 2.

(10) **Small Fruit Culture.**—A study of the methods and principles underlying the culture of bush fruits; their classification and origin. Laboratory and lecture. II, 3.

(11) **Thesis.**—Two credits throughout the senior year will be given for a thesis based upon original research along some horticultural line.

Forestry

(1) **Forest Policy.**—Lectures and text book work pertaining to the policy of the United States government in regard to public forests; the growth and importance of the forest movement in the United States; the policy of the States in regard to State forests, etc. I, 2.

(2) **General Forestry.**—Treating of forest influences on climate, flow of streams, winds, etc. This course is required of all agricultural students, and sophomores in the forestry course. II, 3.

(3) **Silviculture.**—The principles underlying the growth of trees in groups, or in the forest, methods of reproduction; discussion of the different silvicultural systems of management, and the application of each to a given tract and under various forest conditions. I, 3.

(4) **Forest Protection.**—A discussion and study of the methods employed in protecting forests against damage from fire, grazing, careless lumbering, etc. II, 3.

(5) **Forest History.**—A study of the origin and growth of the forestry movement in Europe and the United States. II, 2.

(6) **Forest Laws.**—The laws governing the federal forest reserves; the rules and regulations adopted by the forest service; and the several state laws governing state forests. II, 2.

(7) **Forest Mensuration.**—This subject deals with the determination of the contents of logs, the construction of log rules, methods of scaling logs, estimating and cruising timber, the determination of yield, etc. Lectures, textbooks and extensive field practice. I, II, 6.

(8) **Lumbering.**—A history of the growth and importance of the lumber industry in the United States; the methods of lumbering in different sections of the country; the use of the various kinds of trees; the methods and machinery employed in saw mills in manufacturing saw logs into lumber; methods of lumbering as applied to different parts of the country and with different woods, in order to protect young growth and induce reproduction. This study will require the students to make a working plan of a given tract which is to be lumbered. In order to make the plan the tract will have to be cruised, the different kinds and grades of lumber estimated, the methods to be employed in cutting and logging to save young growth must be determined, logging roads to the mill must be laid out and constructed, the management and location of logging camps must be planned, etc. This course will be given by lectures, text books, required reading and very extensive field work in the forests near Bozeman. I, II, 7.

(9) **Forest Economics.**—This course deals with the position the community and government should take with reference to their forest resources; the business aspects and conduct of forest lands; the relation of the lumber industry to the welfare of the nation, etc. II, 4.

(10) **Thesis.**—Four credits in the senior year are given for work upon a thesis based upon original work in forestry. I, II, 4.

Division of Engineering

The purpose of the courses offered in the division of Engineering is to furnish to the student the fundamental training essential to a successful engineer; this result is accomplished, not alone by the study of the theoretical, by by giving attention to the practical application of the principles involved. A limited degree of flexibility is given the several courses through electives, thus enabling the student to specialize in any chosen study.

Candidates for engineering courses must be graduates from accredited high schools, the college preparatory department, or pass equivalent examinations.

Courses are offered in civil engineering, electrical engineering and mechanical engineering leading respctively to the degrees of Bachelor of Civil, Electrical or Mehcanical, Engineering. On the competion of one year of post graduate work, or three years of professional work and the presentation of an acceptable thesis, the college will confer upon the holders of bachelors' degrees in these courses the degrees respecitvely of Civil Engineer, Electrical Engineer, or Mechanical Engineer.

Civil Engineering

This course has been designed so as to give to the student all of the fundamental studies necessary for the profession and at the same time specially qualify qualify him to best meet the particular classes of engineering work most likely to be required in Montana.

Without overlooking the importance of a thorough knowledge of the fundamental principles of engineering, the course has been designed to partially overcome some of the difficulties encountered by the young engineer in entering the work of practical life. We hope to meet in a small way the lack of understanding of practical rules and methods, for which so many of our college graduates are criticized by the general public and which so handicaps the student upon graduation. Not only is the student taught with the idea of making him an efficient office assistant, but a little insight is given into the practical; he makes estimates of cost of construction and such items as will enable him to appreciate the value and necessity of business and engineering methods, and possibly lead the way to engineering management and contracting.

Special care has been given to perfect the student, as far as possible, in the branches of engineering work which promise the best in the future of this state; namely, road and railway engineering; sanitary engineering; irrigation engineering; hydraulics and water power development.

As far as possible, the student taking this course will be expected to engage in practical engineering work during the summer vacations, and to this end each student registering in the course will be assisted in securing such positions as he may be able to fill at the close of each year. Thus far the demand for such student assistance has exceeded the supply.

The equipment of the department is up-to-date and sufficiently large to meet all present requirements.

In order to meet the demands made upon the college for young men qualified as surveyors and water commissioners, and to confine the main course, as far as possible, to such students as expect to graduate, a short course has been added to the work of the department known as the "Water Commissioner's Course." A description of this course can be found among the short courses in the latter pages of this catalogue.

CIVIL ENGINEERING.

FRESHMAN YEAR.

Algebra (Math. 1)	3	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Descriptive Geometry (M. E. 3)	2
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (1)	1	Public Speaking (1)	1
Inorganic Chemistry (Chem. 1 and 2)	4	Inorganic Chemistry (Chem. 1 and 2)	4
Mechanical Drawing (M. E. 1)	3	Mechanical Drawing (M. E. 3a)	3
Freehand Drawing (Art 3)	2	Freehand Drawing (Art 3)	2
Military Drill	1	Military Drill	1
	18		19

SOPHOMORE YEAR.

		Calculus (Math. 4)	5
Calculus (Math. 4)	5	Electrical Machinery (E. E. 1)	1
Expository Composition (Eng. 2)	2	Cement Tests (C. E. 15)	1
General Physics (Physics 1)	3	General Physics (Phys. 1)	3
Physical Measurem'ts (Phys. 2)	2	Physical Measurements (Phys. 2)	2
Plane Surveying (C. E. 1)	3	Railroad Engineering (C.E. 4)	4
Field Practice (C. E. 1a)	2	Field Work and Plotting (C. E. 4a)	2
Roads and Pavements (C.E. 2)	1		
Military Drill	1	Military Drill	1
	19		19

JUNIOR YEAR.

		Applied Mechanics (C. E. 6)	4
Theoretical Mechanics (C. E. 5)	4	Strength of Materials (M. E. 14)	1
Hydraulics (C. E. 8)	3	Roofs and Bridges (C. E. 13)	2
Irrigation Engineering (C.E. 9)	3	Sanitary Eng (C. E. 14)	4
Field Practice (C. E. 11)	3	Reservoirs and Dams (C. E. 16)	2
Seminar (C. E. 12)	1	Engineering Design (C. E. 13a)	3
Least Squares (Math. 5)	2	Seminar (C. E. 12)	1
Elective	3	Elective	2
	19		19

SENIOR YEAR.

Geodetic Surveying (C. E. 17)	2		
Economics (3)	2		
Water Power Development (C.E. 18)	3	Hydrographic Surveying (C.E.22)	2
Engineering Designs (C.E. 19)	3	Economics (3)	2
Field Practice (C. E. 20)	3	Contracts and Specifications (C. E. 23)	2
Foundations and Masonry (C. E. 21)	2	Cost of Construction (C.E. 25)	2
Seminar (C. E. 12)	1	Engineering Design (C. E. 19)	3
Astronomy (Math. 6)	3	Practical Astronomy (C. E. 24)	2
Thesis		Seminar (C. E. 12)	1
		Thesis (C. E. 27)	5
	19		19

Electrical Engineering

This course provides a thorough technical training in electrical engineering. The rapid development of electrical engineering is largely due to the use of sound theory in the solution of commercial problems. For this reason the theoretical subjects, and the application of theory to the solution of practical problems are emphasized.

The course is designed to teach students the scientific laws and principles forming the basis of the profession, and the application of these laws and principles to commercial problems. The general training consists of courses in mathematics, physics, chemistry, drawing and shop work. The electro-technical work consists of lectures and recitations on the theory of electrical phenomena, and of problems in the design, construction and operation of electrical machines and apparatus. Conventional methods are used in drawing and designing, and the experimental tests made in the laboratory are essentially similar to the tests made by large manufacturing companies. The apparatus and instruments used are of modern commercial types.

The course is supplemented by an annual inspection trip to some of the large power plants of Montana, and by lectures from prominent electrical engineers.

ELECTRICAL ENGINEERING.

FRESHMAN YEAR.

Algebra (Math. 1)	3	Analytical Drawing (Math. 3)	4
Trigonometry (Math. 2)	2	Descriptive Geometry (M.E. 3)	2
English Composition (Eng. 1)	2	English Composition (Eng 1)	2
Public Speaking (1)	1	Public Speaking (1)	1
Inorganic Chemistry (Chem. 1 and 2	4	Inorganic Chemistry (Chem. 1 and 2	4
Mechanical Drawing (M.E. 1)	3	Mechanical Drawing (M.E. 3a)	3
Joinery (M. E. 2)	2	Foundry and Pattern Making (M. E. 4)	2
Military Drill	1	Military Drill	1
	18		19

SOPHOMORE YEAR.

Calculus (Math. 4)	5	Calculus (Math. 4)	5
Expository Composiiion (Eng. 2)	2	General Physics (Phys. 1)	3
General Physics (Phys. 1)	3	Physical Measurements (Phys. 2)	2
Physical Measurements (Phys. 2)	2	Electrical Machinery (E.E. 1)	1
Forge Work (M. E. 6)	2	Dynamo Drawing (E. E. 2)	2
Military Drill	1	Military Drill	1
Electives	4 or 5	Electives	4 or 6
	19 or 20		18 or 20

JUNIOR YEAR.

Theoretical Mechanics (C.E. 5)	4		
Applied Electricity (E.E. 3)	3	Applied Mechanics (C. E. 6)	4
Electricity and Mag. (Phys. 5)	2	Dynamos and Motors (E. E. 5)	4
Electrical Measurements (Phys. 6)	2	Dynamo Design (E. E. 8)	3
Electrical Diagrams (E.E. 7)	2	Strength of Material Lab. (M. E. 14)	1
Electrical Lab. (E. E. 4)	2	Dynamo Testing (E. E. 6)	2
Seminar (E. E. 17)	1	Seminar (E. E. 17)	1
Electives	3	Electives	3 or 4
	19		18 or 19

SENIOR YEAR.

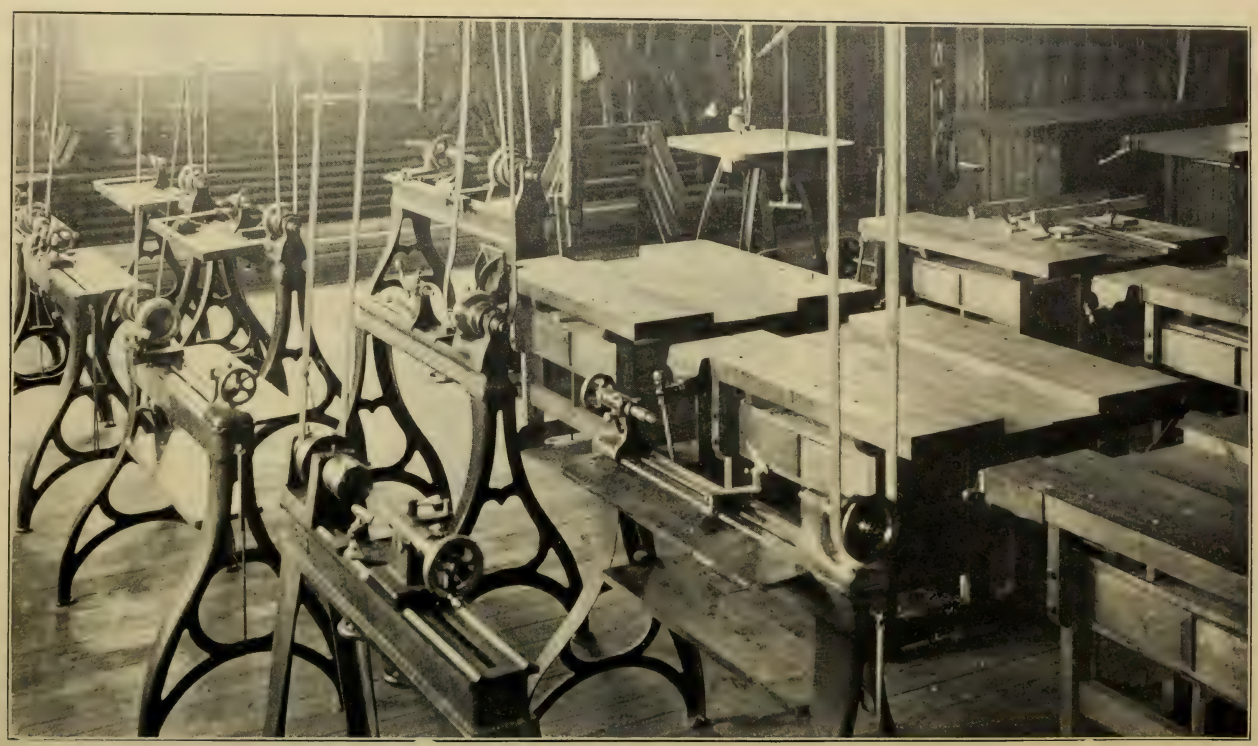
		Alternating Currents (E. E. 11)	4
Alternating Currents (E. E. 9)	4	Economics (3)	2
Economics (3)	2	Alternator Design (E. E. 16)	3
Transformer Design (E .E. 13)	3	Contracts and Specifications (E. E. 14)	1
Power Plant Operation (E.E. 15	1	Polyphase Testing (E. E. 12)	2
Single Phase Testing (E. E. 10)	3	Seminar (E. E. 17)	1
Seminar (E. E. 17)	1	Thesis (E. E. 20)	3
Thesis (E. E. 20)	2	Electives	3
Electives	3		
	19		19

Mechanical Engineering.

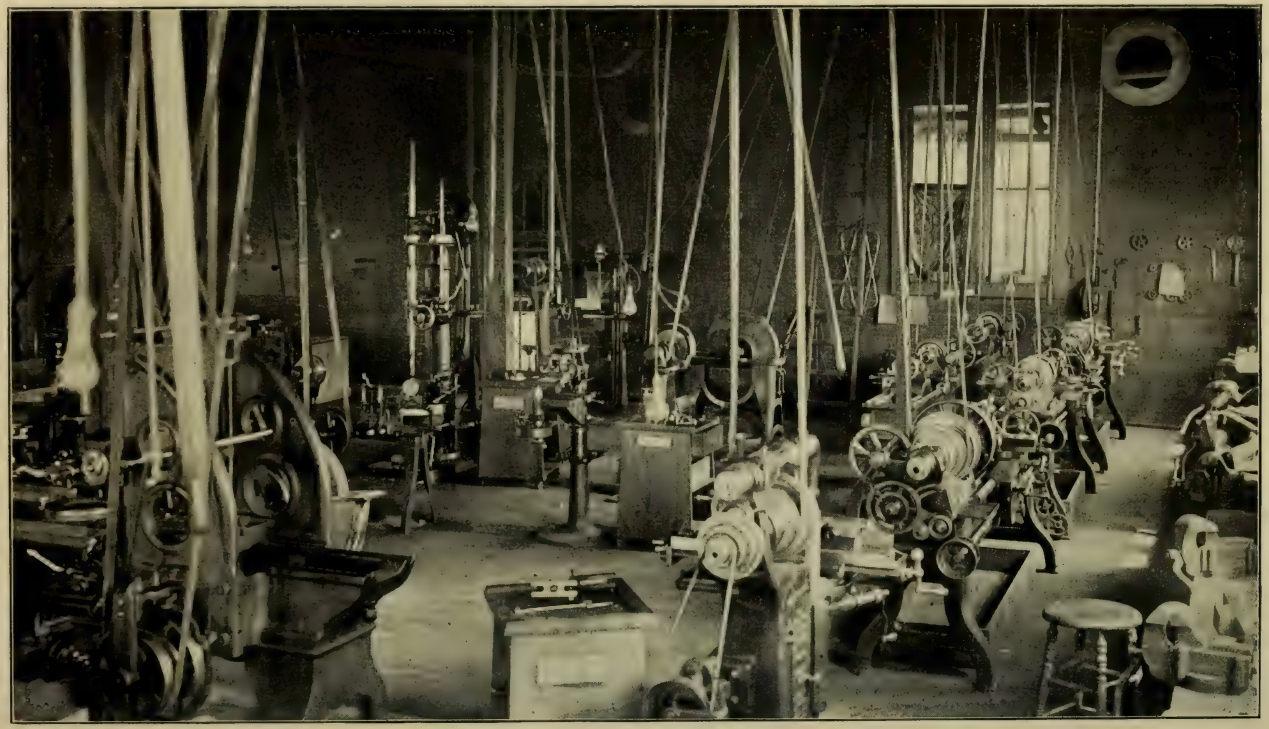
The purpose of this course is to prepare young men as fully as possible, within the limited time, for the management of manufacturing establishments, the designing, construction and erection of machinery, the superintendence of construction, and for other branches of the profesion.

The course comprises four years' instruction and training by text book, lecture, laboratory and shop practice, based on the fundamental subjects, mathematics, physics, chemistry, pure and applied mechanics, machine design, structural design and thermodynamics. It is designed to give the student a thorough knowledge of the basic principles of his profession and such technical skill as the application of theoretical principles in every-day practice in shop and laboratory will insure, and to so strengthen his abilities that his future career may be the most successful of which he is capable.

It is a fundamental principle, recognized by educators, that laboratory and shop work constitute a most important means of illustrating and impressing engineering principles, and with this in view the work of each department, class room, laboratory, shop and designing room is made to supplement the work of each of the others, thus giving a balance in the mental equipment of the young engineer obtainable in no other way. The value of such balance to the engineer at the beginning of his career is recognized in the course offered on the opposite page.



WOOD SHOP.



MACHINE SHOP.

MECHANICAL ENGINEERING.

FRESHMAN YEAR.

Algebra (Math. 1)	3	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Descriptive Geom. (M. E. 3)	2
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (Pub. Sp. 1)	1	Public Speaking (Pub. Sp. 1)	1
Inorganic Chemistry (Chem. 1 and 2)	4	Inorganic Chemistry (Chem. 1 and 2)	4
Mechanical Drawing (M. E. 1)	3	Mechanical Drawing (M. E. 3a)	3
Joinery (M. E. 2)	2	Foundry and Patern Making (M. E. 4)	2
Military Drill	1	Military Drill	1
	18		19

SOPHOMORE YEAR.

Calculus (Math. 4)	5	Calculus (Math. 4)	5
Expository Composition (Eng. 2)	2	Steam Engines and Boilers (M. E. 7)	2
General Physics (Phys. 1)	3	General Physics (Phys. 1)	3
Physical Measurements (Phys. 2)	2	Physical Measurements (Phys. 2)	2
Kinematics (M. E. 5)	2	Electrical Machinery (E. E. 1)	1
Mechanical Drawing (M. E. 5a)	3	Mechanical Drawing (M. E. 8)	3
Forge Work (M. E. 6)	2	Forge Work (M. E. 9)	2
Military Drill	1	Military Drill	1
	20		19

JUNIOR YEAR.

		Applied Mechanics (C. E. 6)	4
		Machine Design (M. E. 13)	3
Theoretical Mechanics (C. E. 5)	4	Strength of Materials Lab. (M. E. 14)	1
Electricity and Magnetism (Phys. 5)	2	Indicators and Valve Gears (M. E. 15)	2
Elect. Measurements (Phys. 5)	2	Mechanical Lab. (M. E. 15a)	1
Applied Electricity (E. E. 3)	3	Boiler Room and Engine Practice (M. E. 16)	2
Electrical Laboratory (E. E. 4)	2	Mechanical Drawing (M. E. 13a)	3
Hydraulics (C. E. 8)	3	Machine Work (M. E. 17)	2
Mechanical Drawing (M. E. 10)	1	Seminar (M. E. 11)	1
Machine Work (M. E. 12)	2		
Seminar (M. E. 11)	1		
	20		19

SENIOR YEAR.

		Thermodynamics (M. E. 22)	2
		Economics (3)	2
Thermodynamics (M. E. 18)	3	Engine Design (M. E. 23)	2
Economics (3)	2	Mechanical Drawing (M. E. 23a)	2
Boiler Design (M. E. 19)	1	Roofs and Bridges (C. E. 13)	2
Mechanical Drawing (M. E. 19a)	3	Engineering Design (C. E. 13a)	3
Mechanical Laboratory (M. E. 20)	3	Contracts and Specifications (M. E. 24)	1
Machine Work (M. E. 21)	2	Shop Management (M. E. 25)	1
Seminar (M. E. 11)	1	Electives	3
Electives	3	Thesis (M. E. 26)	2
Thesis (M. E. 26)	2		
	18		20

CIVIL ENGINEERING

PROF. TANNATT.
MR. ANDERSON.

The equipment of this department consists of two transits, both with solar attachments; four engineers' levels; two plane tables with alidades and declinators; one sextant; artificial horizon; one reflectoscope; two engineers' aneroid barometers; one engineers' compass; one clinometer; one hand level; one stadia hand level; one Burton's transit; five current meters; three automatic water registers; one Fairbanks' briquette testing machine with briquette molds, etc; two vicat needles; one fineness scale; one set assay balances; one odometer; one specific gravity apparatus; one weir measuring device; one adjustable weir; one set of railway curves; one rolling planimeter; one polar planimeter; level and stadia rods; chains, tapes and pins; calculating instruments, etc.

In addition to the above the department is supplied with a good office equipment in the way of draughting instruments, scales, T squares, straight edges, etc.

The quarters of the department are in the second story of the main building and consist of two recitation rooms, one large draughting room and office. The draughting room is well supplied with desks and draughting boards, also a traveling blue print frame capable of printing drawings 36x52 inches. A suitable dark room and apparatus for teaching the methods of making and printing blue-process papers forms a part of the equipment.

(1) **Plane Surveying.**—The use and adjustment of ordinary surveying instruments, such as the compass, level, transit, plane table, and sextant. The theory and practice of land surveying, leveling and topography; keeping of field notes and plotting. Time, 3 hours recitation per week. (C. E. 1a) being also a part of this course. Text, Johnson's "Theory and Practice in Surveying." Prerequisites, mathematics up to and including trigonometry. I, 3.

(1a) **Field Practice.**—The practical use of ordinary civil engineering instruments in field work. Practice in measurement of line and angles with the chain, tape, stadia, and transit. Measurement of fields, volumes, angles, and the calculations derived from same. The use of the level in measuring elevations, establishing grades, measurement of volume, etc. During inclement weather the student will be required to do plotting and make calculations from field notes. This course forms a part of the course in plane surveying. Time, 5 hours per week. I, 2.

(2) **Roads and Pavements.**—A course in good road construction. Different methods of construction considered together with the best forms of surface, cost, etc. The influence of good roads upon property values and

justifiable expense necessary to secure them. Illustrated lecture course. One hour per week. Elective to all regular students of the college or preparatory courses. I, 1.

(3) **Highway Engineering.**—This course is designed to specially qualify the engineer along the lines of highway construction, both city and county. Different surface materials, influence of grades, forms of gutters, culverts, curbing, etc., are carefully studied. This course is specially designed to meet the requirements of the municipal engineer. Elective to all engineering students. Prerequisites, C. E. 1, 2 and 4. Text, Baker's "Roads and Pavements." II, 2.

(4) **Railroad Engineering.**—Railroad reconnoitering, preliminary and location surveys. Theory and practice in laying out railroad curves, turnout, switches, and crossings. Cost of railroad construction, timber, structures and culverts. Making and use of profiles, field maps, cross sections, etc. Calculation of yardage in embankments and excavation. Four hours recitation per week. Prerequisites, C. E. 1 and 1a. Text, Webb's "Railroad Construction." II, 4.

(4a) **Field Work and Plotting.**—Practice in railroad topography, laying out curves and tangents, cross-sections, etc. A preliminary and location survey will be made and the students required to complete all maps, profiles and estimates for same. This course forms a part of C. E. 4. Time, five hours recitation per week. No text required, but the student will be required to provide himself with necessary drawing instruments. II, 2.

(5) **Theoretical Mechanics.**—Kinematics, Newton's laws of motion, dynamics of a particle, statics, friction, work and energy, dynamics of rotation, graphical and analytical methods employed. Text, Wright's "Elements of Mechanics." Time, four hours per week. Prerequisites, mathematics, including calculus, physics 1 and 2. I, 4.

(6) **Applied Mechanics.**—Resistance and elasticity of materials, shear, tension, compression, working stresses, design of riveted joints in pipes and cylinders, stresses in simple and cantilever beams, investigation and design of columns, torsion in shafting for transmitting power, resilience of materials. Text, Merriman's Mechanics of Materials. Time, four hours per week. Prerequisites, C. E. 5; Physics 1 and 2. II, 4.

(7) **Agricultural Mechanics.**—A study of the construction, operation and mechanical principles of the various machines used on the farm. Farm buildings and the adaptability of the different classes of building materials in the construction of the same. Gasoline engines, pumps, binders, mowers, cleaners, and other farm machines will be taken apart and assembled by the student. Special attention will be given to wind mills; steam, gas and gasoline engines and their application to irrigation. The cost of operation and the conditions governing the life and efficiency of different

classes of farm machinery. Text, King's Physics of Agriculture. Time, three hours per week. Prerequisites, Physics 1a. II, 3.

(8) **Hydraulics.**—Theoretical hydraulics; hydraulic measurements; flow of water through orifices, over weirs, through pipes, conduits, and canals. Time, three hours recitation per week. Text, Merriman's Hydraulics. Prerequisites, C. E. 1, 1a, mathematics to and including calculus, physics 1 and 2. I, 3.

(9) **Irrigation Engineering.**—This includes the impounding, diverting, and conveying of water; flumes, ditches, methods of measuring the duty of water and its relation to climate, soils, etc. Drainage of swamp and alkali lands. Three hours recitation per week. Text, Wilson's Irrigation Engineer. Prerequisites, C. E. 1 and 1a, 4 and 4a. Hydraulics must be taken in conjunction with this course. I, 3.

(10) **Drainage and Irrigation.**—Theory and practice of irrigation. The principles underlying the application of water to growing crops. Duty of water and its relation to climate, soils, etc. Prevention of alkali and the reclamation of swamp and alkali lands. Time, three hours per week. lectures and recitations. Text, King's Irrigation and Drainage. Prerequisites, C. E. 1 and 1a.

(11) **Field Practice.**—Practice in the use of engineering instruments in the field. This work is designed specially to develop speed and accuracy and to give practice in the more difficult problems of engineering. Advanced draughting during inclement weather. Time seven and a half hours per week. Regular in civil engineering course. I, 3.

(12) **Seminar.**—In this course each student is assigned weekly an article from some recent publication upon some engineering topic and required to bring in a written synopsis of the same; after the reading of which the subject is thrown open to general discussion. The object of this course is to familiarize the student with recent engineering works, to assist in English composition and public speaking and to point out the essential features of engineering articles. Time, one hour recitation each week. I, 1; II, 1.

(13) **Roofs and Bridges.**—A short course in graphic statics. Theory and calculation of stresses in roof and bridge trusses. Analytical and graphical methods employed. Time, two hours recitation per week; C. E. 13a being a part of this course. Prerequisites, C. E. 5 and 6. Text Johnson's Statics and Merriman-Jacoby's Text-book on Roofs and Bridges. II, 2.

(13a) **Engineering Design.**—The draughting and design of bridges, roof trusses, etc. This is part of the course in roofs and bridges and must be taken in conjunction with the same. Time, six hours per week. II, 3.

(14) **Sanitary Engineering.**—Collection, purification, and distribution of water; systems of water supply and sewerage; disposal of sewerage;

house drainage; sanitary inspection. Time, four recitations per week. Texts, Folwell's Sewerage and Turneaure and Russell's Public Water Supply. Prerequisites, C. E .4, 4a, 5, 6, 8, 9, and M. E. 24. II, 4.

(15) **Cement Tests.**—Study of physical properties of cement. Testing the various natural and hydraulic cements under varying conditions and mixtures. Time, two hours per week. Text, Taylor's Cement Testing. II, 1.

(16) **Reservoirs and Dams.**—This course is designed to supplement the course in irrigation engineering. Study of the best methods of impounding water. Design and construction of earth, rock fill, timber, and masonry dams. Time, one hour recitation, two hours reading and draughting per week. Text. Baker's Foundation and Masonry. Reference, Wegman's Masonry Dam Construction.,,Regular junior study of C. E. course. II, 2.

(17) **Geodetic Surveying.**—Elements of geodesy. Base line measurements, triangulation, determination of true meridian and latitude. Time, two hours recitation per week. Text, Johnson's Surveying. Regular senior study of C. E. course. I, 2.

(18) **Water Power Development.**—A course in the development of water powers. The design and use of the turbine, impulse and other forms of water motors. The design and construction of headraces, spillways, etc. The class will be required, whenever possible, to examine water powers, and report upon their design and method of development. Considerable time will be devoted to the description of recently installed plants as published in the engineering journals. Time, three hours recitation per week. Text, Merriman's Hydraulics and Church's Hydraulic Motors. Prerequisites, C. E. 1, 1a, 5, 6, 8, and M. E. 24. I, 3.

(19) **Engineering Design.**—This period is devoted to the design of engineering works, maps, etc. Time, six hours per week. Regular study in C. E. course. II, 3.

(20) **Field Practice.**—The work of this period is designed to assist in making surveys, etc., preliminary to the thesis. Time, seven and one half hours per week. I, 3.

(21) **Foundations and Masonry.**—This course includes a study of materials and methods employed in the construction of piers, abutments and retaining walls; economy of construction, strength of joined materials; composition of different kinds of mortar; reinforced concrete construction. Time, two hours recitation per week. Text, Baker's Foundation and Masonry. Prerequisites; regular in C. E. course. I, 2.

(22) **Hydraulic Surveying**—This branch of surveying embraces the methods of surveying bodies of water; determining the contour of bottoms of harbors, or sheets of water; the depth of soundings; the position of channels and shoals; measurement of streams and ditches. Time, two hours recitation per week. Text, Johnson's Theory and Practice in Sur-

veying. Prerequisites, C. E. 1, 1a, 4, 4a, 8 and 9. If conditions permit, a portion of the time scheduled will be used in practical water measurement. II, 2.

(23) **Contracts and Specifications.**—The elementary law of contracts and its application to engineering considered, together with the correct form of specifications and the judicial interpretation placed on the technical terms commonly used in engineering specifications. Time, two hours per week. Text, Johnson's Contracts and Specifications. Elective to all engineering students after the sophomore year.

(24) **Practical Astronomy.**—A short course in astronomy designed especially for the civil engineering students and to supplement the astronomy of mathematics. Time, two hours per week. A considerable portion of the time in this course will be given in the form of evening work in taking observations on the circum-polar stars, and a part of the time to solar observations. Text, Comstock's Field Astronomy for Beginners. Prerequisites, mathematics, 6. II, 2.

(25) **Cost of Construction.**—This course is designed to acquaint the student with the cost of labor and materials used in engineering construction; to point out the necessity and means of keeping accurate records of the cost of proposed engineering surveys, maps, reports and the construction work. Time, two hours per week recitation. Text, Gillette's Cost Data. Prerequisites, C. E. 1, 1a, 4, 5, 6, 8, 13 and 13a. II, 2.

(26) **Irrigation Law.**—This course is designed to investigate the irrigation laws of the United States and the state of Montana, with a view of acquianting the student with the general features of the same. Elective to all engineering courses. Prerequisites, C. E. 1, 1a, 8 and 9. This course will be taught only when sufficient number elect the same to justify entering the study upon the schedule. Time, two hours recitation and lectures per week. I, 2.

(27) **Thesis.**—The student will be required before graduation to present a suitable thesis upon some engineering subject in line of his course. A copy of the same, together with all original maps, tables, etc., typewritten, bound, and upon specified paper, will be filed with the college and become the property of the same. The student is required to select his subject at the beginning of the senior year and C. E. 19 and 20 will be arranged to assit in the construction of the same so far as in the judgment of the class officer is thought expedient. I, II, 5.

(28) **Electives.**—Students will be permitted to take any electives for which they are qualified and which they have the time to take. The selection will be subject to the approval of their class officers and the instructor teaching the subject.

ELECTRICAL ENGINEERING.

PROF. THALER.

The electrical engineering department occupies a two story stone building, 36x52 feet. The first floor contains the dynamo laboratory, the machines for testing the strength of material and two steam engines. The second floor contains a class and drafting room, an arc light room, a battery room, a photometer room, and an office. Steam and electrical power are obtained from the main power house.

The equipment of the electrical laboratory is very complete, with apparatus of modern type. There are two double current multipolar generators, capacity 15 K. W. These machines may be driven by the 40 H. P. engine or by the laboratory motor, and may be used as direct current dynamos, as alternators, simple, two or three phase, as synchronous motors or as rotary converters.

The two machines are also used for practice in synchronizing, and furnish alternating current for the induction motors, and for the mercury arc rectifier. For direct current work the laboratory contains in addition to the two generators, one Excelsior 15 light arc dynamo, connected to eight series-arc-lamps, arranged for testing purposes, one 15 H. P. Northern Electric Co. motor, one 10 H. P. Siemens and Halske motor and one 16 H. P. Western Electric Co. bipolar motor, each motor is provided with a friction brake and other auxilliary apparatus for complete tests of the armature and field resistances, of the magnetic distribution and leakage, and of the efficiency and regulation at different loads; one 6 K. W. Excelsior dynamo, which may be used as either a shunt or a compound machine, driven by the 10 H. P. motor and arranged for testing purposes.

For alternating current work the laboratory contains, in addition to the two generators, one mercury arc rectifier, capacity 30 amperes at 110 volts; one 2 H. P. single phase Westinghouse induction motor with phase splitter, provided with a prony friction brake for efficiency and regulation tests at different frequencies and at different voltages; one 6 H. P. three phase General Electric Co. induction motor, also provided with an auxilliary apparatus for testing purposes.

There are six trasformers, with capacities from 1 to 1½ K. W. and with different ratios. The transformers are arranged for testing the core losses, the copper losses, and the efficiency and regulation at various frequencies and voltages. They are also used for practice in transformer connecting for different purposes.

For general testing the laboratory contains one stationary lamp bank of 136 incandescent lamps with a current capacity of 130 amperes at 110 volts; the lamps are arranged so that the current can be regulated

within a small fraction of one ampere; four portable lamp banks of ten lamps each, arranged so that the lamps can be connected either in series or in parallel; one 900 Ohm iron wire resistance and five iron wire resistances for heavy currents, besides a number of rheostats, switches and current breakers.

The laboratory contains twenty-nine electrical measuring instruments, including nine voltmeters; one Whitney 150-300 volts; one Whitney 15 volts; one Weston 150 volts; one Weston milli-voltmeter; one Weston 75-150 volt A. C.; one Westinghouse 150 volts switchboard voltmeter.

We have eight portable ammeters: one 5 ampere D. C. Weston, three Whitnew ammeters, capacity 10, 25 and 50 amperes, D. C. respectively; two Hoyt's A. C. ammeters, 10 and 30 amperes respectively; one G. E. ammeter with series transformer, 120 amperes A. C.; and one Westinghouse ammeter, 120 amperes.

We have four portable wattmeters; one Westinghouse, with series transformer, capacity 100 amperes at 200 volts; one Hoyt, capacity 1500 K. W.; one Weston, with multiplier, 2 amperes at 2250 volts; one G. E. Co. wattmeter, capacity 10,000 watts.

There is one Leeds potentiometer with standard cell and standard resistances for calibrating instruments; one Kelvin standard balance for calibrating wattmeters; one Weston portable galvanometer; one Jacobi testing set for measuring resistances; and four intergrating wattmeters, besides several switchboard instruments.

The arc light room contains eight series-arc-lamps and five constant potential arc lamps of different types arranged for testing.

In the photometer room is a Willyoung station photometer with universal rotator and bunsen screen for testing the candle power, distribution of light, and the efficiency of incandescent lamps.

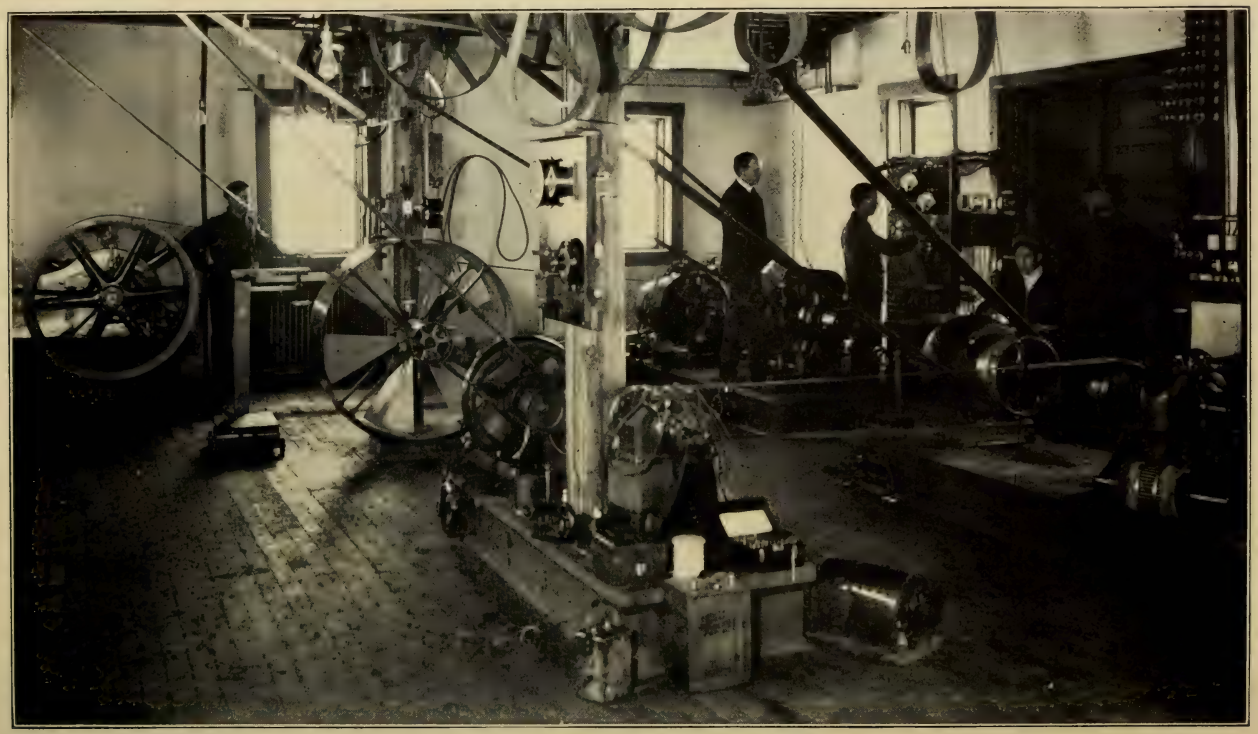
The battery room contains a storage battery of 36 cells at 60 ampere hours capacity, of the following types: 10 chloride accumulators, 10 National Battery Co.'s unit accumulator, 10 Willard cells and 6 American cells. The batteries furnish current for calibrating instruments and are also available for testing purposes.

The office contains a 700 candle power Cooper-Hewitt mercury vapor lamp, a Nerst lamp, and the apparatus for calibrating instruments.

(1) **Electrical Machinery.**—Lectures on the construction, care and operation of commercial electrical machines and apparatus, including batteries, electric lights, dynamos, motors, alternators, transformers and electrical measuring instruments. Soph. E. E. II, 1.

(2) **Dynamo Drawing.**—Detail working, drawing, tracing, and blue printing of electrical machines in the laboratory, to familiarize the student with the conventional methods of representing the different parts of dynamos and motors. Soph. II, 2.

(3) **Applied Electricity.**—Methods and calculations of wiring, theory



ELECTRICAL ENGINEERING.



SURVEYING CLASS.

of primary cells and storage batteries, electric light and electrical measuring instruments. Two recitations and one lecture per week. Prerequisites, Calculus and Physics (1). Textbook, Elements of Electrical Engineering, by Franklin & Esty. Jr. I, 3.

(4) **Electrical Laboratory.**—Tracing circuits and wiring, calibrating instruments, efficiency tests of storage batteries, and the candle power of incandescent lamps. Five hours laboratory work per week. Prerequisites; Physics (2). Text book, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Jr. I, 2.

(5) **Dynamos and Motors.**—Principles of electro-magnetism, theory of dynamo electric machines, the design, construction and regulation of direct current dynamos and motors. Three recitations and one lecture per week. Prerequisites, Physics and Calculus. Text book, Elements of Electrical Engineering, by Franklin & Esty. Jr. II, 4.

(6) **Dynamo Testing.**—Laboratory tests to determine armature and field resistances, magnetic leakage coefficients, characteristic curves and the efficiency and regulation of various types of different current machines. Five hours laboratory work per week. Prerequisites, Physics (2) and (6). Text book, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Jr. II, 2.

(7) **Electrical Diagrams.**—Conventional methods of representing electrical wiring and appliances. Drawings and wiring diagrams of the switchboards in the laboratory and in the power house and diagrams of the wiring of the college buildings. Four hours drawing per week. Jr. I, 2.

(8) **Dynamo Design.**—Problems in designing electro-magnets, dynamos and motors. Complete working drawings and specifications to accompany each design. Six hours per week. Prerequisite, dynamo drawing. Reference, Design of Dynamos, by S. P. Thompson. Jr. II 3,.

(9) **Alternating Currents.**—Theory of alternating currents, properties of alternating current circuits, principles of alternators, transformers, rotary converters and induction motors, methods of testing alternating current apparatus. Three recitations and one lecture per week. Prerequisites, Physics (5). Text book, Alternating Currents, by Franklin & Williamson. Sr. I, 4.

(10) **Single Phase Testing.**—Laboratory tests of single phase alternating current generators, motors and transformers, calibration of alternating current measuring instruments and meters. Seven and one half hours laboratory work per week. Prerequisites, physics (6). Text book, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Sr. I, 3.

(11) **Alternating Currents.**—Development of the symbolic method of Steinmetz, the solution of problems in transformer design and calculation of transmission line by the use of the algebra of complex numbers and by vector diagrams. Two recitations and two lectures per week. Pre-

requisites, alternating currents (9). Text book, Alternating Current Phenomena, by Steinmetz. Sr. II, 4.

(12) **Polyphase Testing.**—Laboratory tests of polyphase alternating current apparatus, including generators, motors, transformers and converters. Efficiency and regulation tests of a mercury arc rectifier; connection of transformers for transforming from three phase to two phase. Five hours laboratory work per week. Prerequisite, alternating current testing. Text book, Laboratory and Factory Tests in Engineering, by Sever & Townsend. Sr. II, 2.

(13) **Transformer Design.**—Design and drawing of transformers to conform with certain specifications of efficiency and regulation. Calculation of the material used and of the cost of the transformer. Six hours designing and drawing per week. Open to students taking E. E. 9 and 11. Sr. I, 3.

(14) **Contracts and Specifications.**—The law of contracts and its application to engineering contracts. Students are required to make specifications for estimates on proposed power plants, transmission lines or electrical apparatus. One lecture per week. Text book, Contracts and Specifications, by Johnson, and Electrical Lighting Specifications, by Merrau. Sr. II, 1.

(15) **Power Plant Operation.**—Practice in the operation and care of boilers, engines, dynamos, motors, electric lights and storage batteries of the college power plant. Sr. I, 1.

(16) **Alternator Design.**—Problems in designing alternators, converters and induction motors. Design and specifications of alternating current circuits. Six hours designing and drawing per week. Prerequisites, alternating currents (9). Sr. II, 3.

(17) **Seminar.**—Weekly meeting for the purpose of discussing current electrical engineering literature. Each student is required to abstract and index engineering periodicals. One hour per week for seniors and juniors. Jr. and Sr. I and II, 4.

(18) **Special Design.**—Design and contruction of some special electrical apparatus or machine. Elective for seniors in electrical engineering. Sr. I or II 3.

(19) **Inspection Trips.**—Annual excursions are made to one of the large power plants. Students are required to observe and make a report of the type and arrangement of the apparatus and of the methods of operation and other points of interest. Required of seniors in electrical engineering.

(20) **Thesis.**—Before graduating each student must present a suitable thesis upon some engineering subject in line with his course. One copy of the thesis will be filed in the college library as the property of the college. The subject for the thesis must be chosen at the beginning of the senior year. Sr. I and II, 5.

MECHANICAL ENGINEERING.

PROF. COUPER.

ASSIST. PROF. DEARBORN.

In selecting and specifying the required work of the mechanical engineering course the idea has been to give the student a knowledge of and some practice in those subjects that are essential in his preparation for the various lines of work generally recognized as belonging to this profession. Where the work of the mechanical engineer overlaps that of the civil or electrical engineer subjects from those courses are included in the requirements of this course, thus giving the student as complete a preparation as could reasonably be demanded of him.

For the drawing in this course there are provided two large well lighted rooms on the top floor of the main building. In one of these rooms there are twenty-eight and in the other twenty double desks, accomodating in all ninety-six students. The college furnishes the drawing boards. The students furnish their own instruments, triangles, scales, etc. square, etc. For instruction in drawing there are numerous models, parts of machinery, blue prints and drawings. The work in drawing is carried on in conjunction with class work in the study of machines, engines and boilers, and in the design of them. Working drawings comprise a considerable portion of the work and in this way the close relation of the drafting room to the shop is emphasized, as the work in the shops is carried on by the use of working drawings similar to those made in the drawing room. The work includes designing, which in addition to applying the principles of machine design develops a certain degree of originality in invention. A blue printing outfit is a part of the equipment of the drawing room.

In the laboratory work of this course the apparatus and experiments are selected to demonstrate as far as possible the class work in the study of engines and boilers and in designing of machinery.

For engine tests there are available an 8x12 high speed Woodbury engine and a vertical 7x7 Detroit engine, in the mechanical engineering laboratory; a 65 H. P. Imperial engine in the college power plant; a compound Advance traction, owned by the college, and a Russell traction engine loaned for experimental purposes. The Woodbury engine is belted to two 15 K. W. generators, which are used to put a load on the engine. The engine has connections and reducing motion for steam engine indicators. A friction brake is fitted to one of the fly wheels, which is flanged to allow for a means of cooling it with a stream of water, thus making it possible to carry on tests of considerable duration. The steam piping is so arranged that the engine may be run condensing or noncondensing, with or without live or exhaust steam in the jackets. The exhaust is

connected to a 50 H. P. Dean Bros. surface condenser. The condensed steam is weighed in tanks placed on Howe scales of 1200 lbs. capacity. The water used for condensing the steam may be measured by a weir or by meters. The 7x7 vertical engine is also provided with the necessary connections and reducing motion for indicator work, and a friction brake for loading the engine. This engine may be connected with the condenser. The eccentric is adjustable on the shaft, and practice is given the student in setting the valve, which is of the piston type, by measurements as well as by using the steam engine indicator.

For steam engine indicator work there are two Crosby and one Thompson indicators. The Crosby indicators have electro magnetic attachments for taking cards simultaneously from each end of the cylinder. There are several reducing motions of the wheel, pantograph and pendulum types; also a planimeter for obtaining the area of indicator cards. The accuracy of indicator springs is tested by attaching the indicator to a drum in which the steam pressure can be regulated, by valves, from zero to boiler pressure. The pressure is obtained by an accurate test gauge attached to the drum. With these instruments the student learns to determine the horse power developed by the engine, to judge whether the valves are properly set, and the method of setting valves correctly.

Boiler tests are made on the water tube and horiontal multi-tubular boilers of the power plant and on the two traction engines already mentioned. For this work there are provided tanks, scales, thermometers, pyrometers, steam gauges, etc. A new Crosby steam gauge testing outfit affords a means of calibrating all the gauges used in this work. Schaeffer and Budenburg throttling and separating calorimeters are used to determine the condition of the steam. A No. 6 Lunkenheimer injector is used in making tests of the capacity and efficiency of this class of apparatus.

An aluminum Corliss valve model about two feet long, having all the parts of a valve of this class, is used to show the action of the valves and the method of adjusting the valve gear. A plain slide valve model about four feet long, designed and built at the college, gives opportunity to study, under favorable conditions, all the variations to which a slide valve is subject. This model is very carefully constructed and graduated so that it may be used forchecking slide valves designed to fulfill various conditions.

A Riehle testing machine of 100,000 lbs. capacity is used for testing the strength of materials used in engineering and to confirm formulas and values used in machine design and structural work. This machine is provided with all the necessary grips and blocks for making tension, compression and transverse tests of metals, woods, stones, bricks and cement. A magnetic friction clutch my be used to automatically adjust

the balance. Mounted on the machine is an automatic attachment for obtaining the characteristic curves of materials subjected to the various stresses. In addition to these is an extensiometer with double micrometer screws reading to ten-thousandths of an inch and deflectometer reading to thousandths of an inch.

Torsion tests are made on an Oleson torsion machine, capable of breaking a specimen one and one quarter inches square. For measuring specimens there is a two inch micrometer caliper and a twelve inch steel scale. Specimens to be tested are prepared in the shop, thus giving the students additional opportunity to become acquainted with the characteristics of the materials used in engineering and to appreciate more fully the objects and results of the tests. Samples of the specimens are analyzed by the chemical department and the results recorded with the tests.

The shops of the college are equipped with standard machinery and tools for working wood and iron. This equipment is being constantly added to as required, both by purchase and manufacture in the shops.

The forge shop is 28x36 feet and contains eleven Buffalo down draft forges, operated by Sturtevant blowers, as well as a full equipment of anvils and small tools. A fifty pound trip hammer, shear, Gisholt tool swage blocks, etc., are also included. In the work here a graded series of exercises leads the student from simple drawing and upsetting to size, to complex forging and tool making, hardening and tempering, all the work being done from working drawings.

There is a brass foundry 24x28 feet, equipped with brass furnace, core oven, crucibles, flasks, patterns, etc. The work comprises bench and floor molding, melting, pouring, etc., and is carried on in conjunction with pattern making, lectures pertaining to both general foundry practice and pattern making being given at the same time. The castings produced are made use of in the machine work.

The machine shop is a room 60x72 feet. Adjoining the general machine shop are the tool room, stock room, office, lavatory and locker room. The equipment includes an 18 inch Davis & Egan, a 16 inch LeBlond and three 16 inch Flather engine lathes, a 22 inch Flather planer, 16 inch Davis & Egan shaper, a 28 inch Cincinnati drill, an 18 inch Prentice drill, a 14 inch sensitive drill, a No. 1 Cincinnati universal milling machine, a 24 ince Barnes grinder, 4 inch pipe machine, speed lathe, power hack saw, etc., and in the tool room a Cincinnati universal grinder, a Gisholt tool grinder, drill grinder ,etc., besides a complete equipment of small tools. A tool checking system affords additional means of illustration of modern practice.

The wood shop is a room 36x50 feet and is furnished with modern wood working machinery, including a 20 inch planer, 14 inch circular pattern saw, 36 inch saw, universal jointer, jig saw, trimmer, mortiser, 16 inch pattern lathe, seven 10 inch turning lathes with tools, and fifty-six com-

plete sets of carpenter tools, with benches for joinery, cabinet work and pattern making.

(1) **Mechanical Drawing.**—The use of drawing instruments and plain lettering; problems in geometric construction to teach accuracy in the use of instruments; isometric and cabinet projections and simple perspective. Fr. I, 3. Prof Couper.

(2) **Joinery.**—A graded set of problems is given with instruction in the proper use and care of carpenter's tools and practice in working to dimensions from blue prints. Fr. I, 2 Assist. Prof. Dearborn.

(3) **Descriptive Geometry.**—Projections of lines, plane surfaces and solids; intersections, tangents to curves and surfaces; problems in warped surfaces; practical applications of principles to useful problems. Text, Faunce. Fr. II, 2. Prof. Couper.

(3a) **Mechanical Drawing.**—Problems in descriptive geometry; find the position of points, lines and surfaces; inter-section of solids, development of surfaces; making patterns for such objects as bath tubs, boiler sheets, and other sheet metal work. Fr. II, 3. Prof. Couper.

(4) **Foundry and Pattern Making.**—Includes practice in floor and bench molding, core making, and pouring, with lectures on general foundry practice. Also a series of exercises in wood turning and pattern making and the use of wood working machinery. Fr. II, 2.
Assist. Prof. Dearborn.

(5) **Kinematics.**—A study of the relative motions of machine parts, including belting, toothed gears, cams and linkages. The class room work is supplemented by a parallel course in drafting. Text, Schwamb & Merrill, Elements of Mechanisms. Soph. I, 2. Prof. Couper.

(5a) **Mechanical Drawing.**—Applications of the principles of kinematics and drawing velocity diagrams, spur and bevel gears and cams. Soph. I, 3. .. Prof. Couper.

(6) **Forge Work.**—A graded set of exercises in iron forging, designed to teach the operations of drawing, upsetting, forming and welding, with lectures on the manufacture and properties of iron and steel, standard specifications, etc. Soph. I, 2. Assist. Prof. Dearborn.

(7) **Steam Engines and Boilers.**—A study of the different types and their classification. A description of the various parts and their uses, together with a careful study of combustion and the properties of steam. The care and operation of engines and boilers as regards safety and economy. Text, Spangler, Green and Marshall, Elements of Steam Engineering. Soph. II, 2. Assist. Prof. Dearborn.

(8) **Mechanical Drawing.**—Special applications of the principles of mechanical drawing. Working drawings, tracings and blue printing. Soph. II, 3. Prof. Couper.

(9) **Forge Work.**—A continuation of the work in iron forging, together

with the making of steel tools, including tempering, annealing and case-hardening. Soph. II, 2. Assist. Prof. Dearborn.

(10) **Mechanical Drawing.**—A continuation of mechanical drawing (8) in which the work will be detail drawings of machine parts preparatory to the work of machine design. Jr. I, 1. Prof. Couper.

(11) **Seminar.**—Weekly meetings held for the purpose of discussing current engineering literature. Each student will be required to abstract and index engineering periodicals. Jr. I, II, 2; Sr. I, 1.
Prof. Couper and Assist. Prof. Dearborn.

(12) **Machine Work.**—Bench work, including chipping, filing, fitting, scraping, laying out work from blue prints; with lectures pertaining to the work. Prerequisites M. E. 4, 6 and 9. Jr. I, 2.
Assist. Prof. Dearborn.

(13) **Machine Design.**—Class room work in the study of machines in regard to size, form and strength. The developments and the application of mathematical formule to the solution of problems in designing machinery. Prerequisites, M. E. 5 and 5a and C. E. 5. Text, Jones, Machine Design. Jr. II, 3. Prof. Couper.

(13a) **Mechanical Drawing.**—Applications of the principles of machine design to size, form and strength of machines and machine parts. Jr. II, 3. Prof. Couper.

(14) **Strength of Materials, Laboratory.**—Each student is required to make a definite series of tests of wrought iron, cast iron, steel and wood in tension, compression, bending and torsion. Prerequisites, C. E. 5. Jr. II, 1. Prof. Couper.

(15) **Indicators and Valve Gear.**—A study of the slide valve, both in its simple form and when used in combination with independent cut-off valves, link motions and other reversing gears; automatic cut-off gears, and the Zeuner diagram; principles and operation of the indicator. Prerequisites, M. E. 7. Text, Spangler's Valve Gears. Jr. II, 2.
Prof. Couper.

(15a) **Mechanical Laboratory.**—Setting of valves with and without the use of the steam engine indicator. Testing of indicator springs and determining the horse power of engines by using the indicator and brake. Each class designs and constructs a reducing motion for some engine or pump. Prerequisites, M. E. 7. M. E. 15 must be carried in conjunction with this subject. Jr. II, 1. Prof. Couper.

(16) **Boiler Room and Engine Practice.**—Each student spends five hours per week as assistant in the college power plant, obtaining practical experience under a first-class engineer in handling boilers, pumvs, engines, heating apparatus and electrical machinery, including dynamos, motors and switch board. Prerequisite, M. E. 7. Jr. II, 2.
Assist. Prof. Dearborn.

(17) **Machine Work.**—Instruction and practice in lathe work, drilling, boring, thread and gear-cutting, with lectures. Prerequisite, M. E. 4, 6, 9, 12. Jr. II, 2. Assist. Prof. Dearborn.

(18) **Thermodynamics.**—A thorough course in theory, and its application, especially to steam engines. Prerequisite, Phys. 1 and2, M. E. 7, 15 and 15a. Text, Peabody, Thermodynamics of the Steam Engine. Sr. I, 3. Assist. Prof. Dearborn.

(19) **Boiler Design.**—A study of steam boilers with reference to setting, capacity, strength and construction. Specifications of material to be used and method of handling. Prerequisite, M. E. 7, 13, 14 and 16. Text, H. De B. Parsons, Steam Boilers. Sr. I, 1. Prof. Couper.

(19a) **Mechanical Drawing.**—A completion of the drawing in machine design and the making of drawings for a steam boiler. Prerequisite, M. E. 13a. Sr. I, 3. Prof. Couper.

(20) **Mechanical Laboratory.**—Calibration of instruments and apparatus for testing, including indicator springs, steam gauges, meters, scales and reducing motions; testing of injectors, condensers, boilers, steam and gas engines, together with calorimetric determination of the condition of steam by means of both the separating and throttling calorimeters. Testing of flue gases and the determination of the calorific values of coals. Complete test of power plant. Prerequisite, M. E. 7, 15 and 15a. Sr. I, 3. Prof. Couper.

(21) **Machine Work.**—Advanced work on lathe, grinder and milling machine; tool making. Prerequisite, M. E. 17. Sr. I, 2. Assist. Prof. Dearborn.

(22) **Thermodynamics.**—The laws of thermodynamics as applied to gas engines and refrigerating machinery. Prerequisite, M. E. 18. Text, Peabody. Sr. II, 2. Assist. Prof. Dearborn.

(23) **Engine Design.**—The constructive details of some type of automatic cut-off engine will be worked out in the class room, and working drawings thereof made in the drafting room. Prerequisite, M. E. 7, 13, 14, 15, 15a, 16, 18. Text, Whitman, Steam Engine Design. Sr. II, 2. Prof. Couper.

(23a) **Mechanical Drawing.**—Designing and drawing of plans for engines and steam appliances. Sr. II, 2. Prof. Couper.

(24) **Contracts and Specifications.**—The various forms of contracts and the value and necessity of contracts drawn up in legal form will be given by some one in the legal profession. The work in specifications will be to examine the common forms in use and write up complete sepecifications for some engineering project. Text, Johnson, Contracts and Specifications. Sr. II, 1. Prof. Couper.

(25) **Shop Management.**—Lectures on the organization and arrangement of manufacturing plants; cost accounting, shop methods, duplica-



ENGINEERS' SOCIETY.



FRESHMAN CLASS.

tion of work. Prerequisite, M. E. 21, Sr. II, 1. Assist. Prof. Dearborn.

(26) **Thesis**—Before graduation each student must present a suitable thesis, which shall be the result of original investigation. The subject must be chosen at the beginning of the senior year. Sr. I, II, 3.

Prof. Couper.

Division of Science

The college offers five separate courses leading to the degree of bachelor of science, which are tabulated on the following pages. It will be noted that in these tabulations there is but little change in the actual requirements from the work offered during the past eight years. In the earlier years of the course, as heretofore, much of the foundation work in science, language and mathematics is common to all the courses.

The names given to these courses are generally indicative of their nature,—Biology, Chemistry, Domestic Science, History-Literature, and Mathematics-Physics.

Candidates for the bachelor's degree in science must complete satisfactorily not less than 130 credits, including the prescribed work in military drill or domestic science; and including also a thesis, the value of which in credits shall be determined by the instructor concerned. No regular student may take in any one semester work amounting to more than nineteen credits or less than twelve.

Students who are relieved for any reason of the requirements in military drill or domestic science, shall present four additional credits in some other subject; but the president may, at his discretion, excuse from such requirements any student in the employ of the institution.

Several subjects taught in departments not represented in this division are open to election by students in science on consent of their advisers. Among these may be mentioned music, (limited to four credits for any one person) and such subjects in the divisions of agriculture or engineering as the applicants may be qualified for, and as the schedule permits. In general the credits to be allowed for these are to be determined by the agreement of the instructors concerned.

A more detailed statement of the direct purpose of these courses may be found just preceding the tabulation of each course.

Biology

Through the electives allowed in the biology course the student may select lines leading toward the following professions: general zoology, general botany, economic entomology, plant pathology, and bacteriology. The course also furnishes an excellent preliminary training for the professions of medicine, veterinary science, forestry, and teaching. In the government service, both in the Department of Agriculture at Washington and in the various experiment stations, there are many desirable openings both for young men and young women. In plant pathology, bacteriology and entomology there is a growing demand for suitably qualified workers. Women are more and more in demand as scientific clerks and assistants. The passage of the Adams act whereby the federal appropriation to the experiment stations in the various states is materially increased, is creating a greater demand for workers in biological as in other lines, and as never before the outlook in these lines is inviting.

The biology course is characterized by wide privileges in electing but it is intended that the student shall be guided by his class officer in selecting the subcourses that contribute most directly to his line of work.

For graduation from the course in biology, one year of Latin and a reading knowledge of French and German are required. More of each is desirable but as soon as these amounts are accomplished, the student may elect other subjects in place of foreign language.



BIOLOGY

FRESHMAN YEAR.

Invertebrate Zoology (Biol. 1)	5	General Botany (Biol. 9)	5
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking	1	Foreign Language	4
Foreign Language	4	Inorganic Chemistry (Chem. 1 & 2)	4
Inorganic Chemistry (Chem 1 & 2)	4	Drawing from Nature (Art 4)	1
Drawing from Nature (Art 4)	1	Drill or Domestic Science	1
Drill or Domestic Science	1		
	18		17

SOPHOMORE YEAR.

Plant Physiology and Histology (Biol. 10)	4	Animal Physiology (Biol. 3)	4
Expository Composition (Eng. 2)	2	Expository Composition (Eng. 2)	2
Algebra & Trigonometry (Math. 1 & 2)	5	Foreign Language	4
Foreign Language	4	Analytic Geometry (Math. 3)	4
General Descriptive Physics (Phys. 1a)	3	General Descriptive Physics (Phys. 1a)	3
Organic Chemistry (Chem. 10)	3	Organic Chemistry (Chem. 10)	3
Drill or Domestic Science	1	Drill or Domestic Science	1
	19		18

JUNIOR YEAR.

General Entomology (Biol. 4)	4	Vertebrate Zoology (Biol. 2)	4
or Bacteriology (Biol. 4)	4	English Literature (Eng. 10)	2
English Literature (Eng. 10)	2	Foreign Language	4
Foreign Language	4	Paleontology (Geol. 2)	3
Geology (Geol. 1)	2	Elective	0 to 6
Elective	1 to 7		
	19		19

SENIOR YEAR.

Thesis	5	Thesis	5
Advanced Composition or Literature (Eng. 3 or 11)	2	Advanced Composition or Literature (Eng. 3 or 11)	2
Economics (3)	2	Economics (3)	2
Psychology (1)	3	Ethics (2)	3
Elective	1 to 7	Electives	1 to 7
	19		19

Chemistry

The object of the course in chemistry is, in general, to so thoroughly educate the student in English, the modern languages and in the fundamental sciences, mathematics, physics and chemistry, that after he graduates from this course he will have the reading and writing ability and the scientific attainment requisite to continue in, and make a success of any kind of theoretical or applied chemistry which he may wish to take up for a life work.

The field of chemistry is exceedingly broad and varied and demands men of very different attainments in the different lines of work. There is always a demand in factories and state experiment stations for analytical chemists, and now there is a growing demand for good teachers in chemistry. The wholesome growth of manufacturing industries throughout the West calls for chemists who are not only well grounded in this science, but who are also educated along engineering lines, so that they have some inventive ability. Such men should be in a position to forsee the need for certain factories and be able to help in planning their location and construction. Recent state and federal enactments also call for chemists of liberal education to analyze foods, and especially to solve the many intricate problems of research work dealing with plant and animal life on the ranch and on the farm.

The curriculum for the first two years is the same for all chemists, but opportunity is granted in the junior and senior years to specialize in a particular line. If a student is desirous of becoming an analyst, he will be directed to take more analytical work, if he wishes to go into manufacturing, he will take engineering work; and, lastly, if he wishes to pursue any line of biochemical research, he will take advanced work in organic chemistry, and in bacteriology, offered by the biology department. In every case the more advanced work will be outlined as much as possible to suit the individual needs of the student.

The curriculum does not call for any entrance requirement in chemistry or the modern languages, but it is earnestly recommended that these subjects be presented for admission to the course, as much valuable time could thereby be gained for the more strictly collegiate work.

CHEMISTRY

FRESHMAN YEAR.

Algebra (Math. 1)	3	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Inorganic Chem. (Chem. 1& 2)	4
Inorganic Chem. (Chem. 1 & 2)	4	English Composition (Eng. 1)	2
English Composition (Eng. 1)	2	German or French	4
German or French	4	Blowpipe Analysis (Chem. 19)	1
Crystallography (Geol. 4)	2	Mineralogy (Geol. 5)	2
Drill or Domestic Science	1	Drill or Domestic Science	1
	18		18

SOPHOMORE YEAR.

German or French	4	German or French	4
Expository Composition (Eng. 2)	2	Expository Comp. (Eng. 2)	2
Physics (Phys .1a)	4	Physics (Phys. 1a)	4
Calculus (Math. 4)	5	Calculus (Math. 4)	5
Organic Chemistry (Chem. 10)	3	Organic Chemistry (Chem. 11)	3
Drill or Domestic Science	1	Drill or Domestic Science	1
	19		19

JUNIOR YEAR.

French or German	4		
Quantitative Analysis (Chem. 5)	5	German or French	4
Advanced Inorganic Chem. (Chem. 3)	3	Quantitative Anal. (Chem. 7)	5
General Qual. Analysis (Chem. 21)	1	Advanced Inorganic Chem. (Chem. 3)	3
Seminar (Chem. 17)	1	General Qual. Anal. (Chem. 21)	1
		Seminar (Chem. 17)	1
	14		14

SENIOR YEAR.

Economics (Econ. 3)	2	Economics (Econ. 3)	2
Physical Chem. (Chem. 4)	3	Physical Chem. (Chem. 5)	2
Quantitative Analysis (Chem. 12)	5	Proximate Organ. Anal. (Chem. 13)	3
or Food Chem. (Chem. 9)	4 or 5	or Food Chem. (Chem. 15)	4
Agri. and San. Chem. (Chem. 9)	2	Agri. and San. Chem. (Chem. 9)	2
Thesis (Chem. 19)	2	Thesis (Chem. 19)	2
	13 or 14		12 or 13

ELECTIVES JUNIOR OR SENIOR YEAR.

Geology (Geol. 1)	2	Palaeontology (Geol. 2)	2
Invert. Zoology (Biol. 1)	5	General Botany (Biol. 9)	5
Applied Mechanics (C. E. 5)	4	Applied Mechanics (C. E. 6)	4
Soil Physics (Agron. 3)	5	Soil Fertility (Agron. 5)	4
Applied Electricity (E. E. 3)	3	Ethics	3
Electrical Lab. (E. E. 4)	2	Electri. Mach. (E. E. 1)	1
Inorganic Prep. (Chem. 8)	4	Strength of Mat'ls (M. E. 4)	1
Psychology	3	Assaying (Chem. 16)	3
Elect. Measurements (Phys. 6)	2	Dyn. and Motor (E. E. 5)	4
Bacteriology (Biol. 12)	4	Toxicology (Chem. 14)	2
Teacher's Course (Chem. 22)	2	Mechanical Drawing (M. E. 1)	3

Domestic Science.

The object of this course is twofold: First, to give young women a liberal education with a scientific basis and to train them along lines pertaining to the science, management and care of the home. Music. literature and art are elective studies.

Second, to give training to those who wish to become teachers of domestic science. This course gives an opportunity for the combination of biology or chemistry with domestic science.



Kitchen

DOMESTIC SCIENCE.

FRESHMAN YEAR.

Trigonometry (2)	3
Chemistry (1 & 2)	4
English (1)	2
Public Speaking (1)	1
Foreign Language (Ger., Fr., or Lat.)	4
Art	1
Cooking (1)	1
Algebra (2)	2
or Domestic Science (2 and 11)	2

Chemistry (1 & 2)	4
English (1)	2
Public Speaking (1)	1
Foreign Language (Lat., Fr. or Ger.)	4
Art	1
Cooking (1)	1
Anal. Geometry (3)	4
or Domestic Science (2 & 11)	4

SOPHOMORE YEAR.

Domestic Science (3)	2
Foreign Lang. (Ger., Fr. or Lat.)	4
History (1)	2
Biology (1)	5
Sewing (12)	2
Elective	2 or 4
Art., Eng., Math., or Phys.	

History (1)	2
Foreign Lang. (Ger., Fr., or Lat.)	4
Physiology (Biol. 3)	5
Domestic Science (3)	2
Sewing (12)	2
Elective	2 or 4
Art, Eng., Math., or Phys.	

JUNIOR YEAR.

English	2
Bacteriology (12)	4
Economics (3)	2
Chemistry (15)	4
Sewing (13)	1
Elective	2 or 4
Music, Hist., Phys., Lang., Art.	

English	2
Entomology (7)	2
Economics (3)	3
Chemistry (15)	4
Domestic Science (5)	2
Sewing (13)	1
Elective	2 or 6
Music, Hist., Phys., Lang., Art.	

SENIOR YEAR.

Psychology (1)	3
English	2
Domestic Science (6 & 7)	2
Sewing (9a)	2
Chem., or Biol., or Phys. (7)	4
Thesis	2
Electives	5

Ethics (2)	3
English	2
Domestic Science (6 & 7)	2
Sewing (9a)	2
Chem., or Biol., or Phys. (7)	4
Thesis	2
Electives	5

History and Literature

In accordance with the general plan of the division of science, this course leads to the degree of bachelor of science. It includes properly therefore strong courses in chemistry, biology, and physics, though it does not contemplate advanced work in any of these subjects. Throughout the course a large amount of time is devoted to the study of foreign language and during the later years of the course a good deal of time is given to history and literature. It is not expected that the graduate in this course will be technically equipped in any of these subjects, though by the systematic arrangement of his electives he may emphasize such lines of the work as he is especially attracted to. Graduates should therefore be fitted to teach in the high schools, history, English, and one or more of the foreign languages. The prime purpose of the course, however, is to offer to those who can afford it a good general education, the purpose of which shall be a wide acquaintance and sympathy with the most important ideas and activities of civilization.

Such an education, it is believed, is well worth having for its own sake; and for those who can afford the time, is a valuable preparation for the specialization of the graduate school, or of the professional or technical school.



History Class Room



LIBRARY AND READING ROOM.



MINERAL MUSEUM.

HISTORY—LITERATURE.

FRESHMAN YEAR.

Algebra (Math. 1)	3
Trigonometry (Math. 2)	2
Foreign Language (Fr., Ger. or Latin.)	4
Inorganic Chemistry (Chem. 1 & 2)	4
English Composition (Eng. 1)	2
Public Speaking (1)	1
Military Drill or Domestic Science	1
Art	1

Anal. Geometry (Math. 3)	4
Foreign Language (Fr., Ger. or Lat)	4
Chemistry (Chem. 1 &2)	4
English Composition (Eng. 1)	2
Public Speaking (1)	1
Military Drill or Domestic Science	1
Art	1

SOPHOMORE YEAR.

Foreign Language	6 or 7
English Composition (Eng. 2)	2
English History (Hist. 1)	2
English Literature (Eng. 10)	2
Invertebrate Zoology (Biol. 1)	3
Military Drill or Domestic Science	1
Elective	0—2

Foreign Language	6 or 7
English Composition (Eng. 2)	2
English Literature (Eng. 10)	2
English History (Hist. 1)	2
General Botany (Bot. 9)	5
Military Drill or Domestic Science	1
Elective	0—2.

JUNIOR YEAR.*

Gen. Descriptive Phys. (Phys. 1a)	3
Economics (3)	2
Foreign Language (3)	3
English (2)	2
or History	3
Elective	3—9.

Gen. Descriptive Phys. (Phys. 1a)	3
Economics (3)	2
Foreign Language	3
English	2
or History	3
Constitution of U. S. (Pol. Sci. 1)	2
Elective	2—6.

SENIOR YEAR.

Psychology (1)	3
Sociology (Pol. Sci. 2)	3
Elective	9—13.
At least 4 credits must be taken in either History, English or Foreign Language.	

Ethics (2)	3
Thesis (3)	6
Elective	10—16 .
At least 4 credits must be taken in either History, English or Foreign Language.	

* The order in which the required subjects are to be taken up in the junior and senior years may be varied upon the consent of the class officer and the instructor concerned.

Mathematics and Physics

This course as outlined on the opposite page is designed to fill the needs of two or three classes of students. The required work is such as to give an excellent preparation for students desiring to become teachers in these subjects and by proper choice of the electives a broad education in other subjects may be obtained. Prospective teachers are advised to arrange their electives so that they will be qualified to teach other subjects such as biology, chemistry, English or foreign language, as often they are required to teach such subjects in combination with mathematics or physics.

There is an increasing demand for men who have a more extended and exact knowledge of these fundamental sciences than can be obtained from the ordinary technical course. This call comes from a class of employers who desire men so equipped and prefer to give them the practical training they need. This course is designed to give just such training. If the student should take this course planning to take an engineering course later he can choose his electives so that any of the engineering courses may be completed in two years after graduation from the Mathematics-Physics course. In this case the following subjects are suggested from which it is desirable to elect: Freehand drawing, mechanical drawing, chemistry, mechanics, applied electricity, dynamos and motors, hydraulics, sanitary engineering. The particular electives of this course will be chosen in accordance with the direct aim of the student. In addition, the above course lays a foundation for the work of the graduate school.

MATHEMATICS-PHYSICS.

FRESHMAN YEAR.

Algebra (Math. 1)	3
Trigonometry (Math. 2)	2
English Composition (Eng. 1)	2
Public Speaking (1)	1
German or French	4
Gen. Inorganic Chem. (Chem. 1)	2
Gen. Inorganic Chem. (Chem. 2)	2
Military Drill or Domestic Science	1
Anal. Geometry (Math. 3)	4
English Composition (Eng. 1)	2
Public Speaking (1)	1
German or French	4
Gen. Inorganic Chem. (Chem. 1)	2
Gen. Inorganic Chem. (Chem. 2)	2
Military Drill or Domestic Science	1

SOPHOMORE YEAR

Calculus (Math. 4)	5
General Physics (Phys. 1)	3
Physical Measurements (Phys. 2)	2
German or French	3 or 4
Expository Composition (Eng. 2)	2
Elective	0 to 4
Calculus (Math. 4)	5
General Physics (Phys. 1)	3
Physical Measurements (Phys. 2)	2
German or French	3 or 4
Expository Composition (Eng. 2)	2
Elective	0 to 4

JUNIOR YEAR.

Differential Equations (Math. 10)	3
Electricity and Magnetism (Phys. 5)	2
Physical Measurements (Phys. 6)	2
or Least Squares (Math. 5)	2
Dyn. and Structural Geol. (Geol. (1)	2
Economics (3)	2
Elective	6 to 10
Differential Equations (Math. 10)	3
Light and Sound (Phys. 3)	2
Physical Measurements (Phys. 4)	2
Economics (3)	2
Elective	6 to 10

SENIOR YEAR.

Astronomy (Math. 6)	3
Two Courses from Advanced Physics (Phys. 7)	3
Mathematics (11, 12, 13, 14,)	2 or 3
Elective and Thesis	7 to 11
Astronomy (Math. 6)	3
Two Courses From Advanced Physics (Phys. 7)	3
Mathematics (11, 12, 13, 14)	2 or 3
Elective and Thesis	7to 11

Art.

MRS. MARSHALL.

Upon entering the art department we find ourselves in a suite of spacious studios, occupying the one hundred foot north front of College Hall, and lined with objects of art.

Many of them are plaster casts from the antique, comprising, among other things, full length figures of the Venus of Milo, the Running Gladiator, and the Winged Victory. There are also portrait busts of Cicero, Sophocles, and other celebrated characters, and many masks of different types and nationalities.

There are many fine reproductions of the Barrie bronzes and other casts of animals, birds, flowers, and fruits. Many of the great styles of architecture and ornament are represented in plaster, from Egyptian down to the Renaissance.

We shall find many photographs from foreign countries, and reproductions of celebrated pictures in engravings and etchings. There is also a fine collection of works on art, suitable for class reading or serious study.

Among other equipment for work the department has a china kiln of the largest size, in which the china painted by the classes is fired on the premises.

There are full sets of tools for wood carving, which are at the service of students, and an instrument for pricking and applying patterns for embroidery.

If we visit the studios during the class hours we find students working in many branches of art,—some in wood carving and clay modeling, some in painting on china, while in other rooms they may be drawing from the antique, painting in water-color, oil, or pastelle, studying applied design or taking lessons in perspective, or other work connected with the engineering departments.

Lectures on art often take the shape of imaginary tours in the great cities, and through the great galleries of the world, and are illustrated by pictures and stereopticon.

(1) Drawing from the cast, in charcoal, crayon or pen and ink, still life and object drawing, sketching from nature, when the weather will permit. Study of plant forms, with suggestions for their application to design. In object drawing the pupil is required to study artistic grouping and good arrangement of light and shade. Memory and time drawing—blackboard work.

(2) **Painting**—in oil, water color or pastelle. No. 1 prerequisite.

(3) **Freehand Drawing for Engineers.**—Perspective as applied to sketching from natural objects, freehand lettering, blackboard dictation, object drawing, with proper shading, freehand drawing of machinery, use

of water color in connection with mechanical work, study of architectural styles, tests for color signals. I and II, 4.

(4) **Drawing From Nature**—Drawing and painting of plants and animals, intended especially for students in biology. It may be taken in either semester separately. I and II, 2—6.

(5) **Normal Work**—This is a course in the training of the eye and hand and in the methods of teaching, intended especially for those who may be planning to teach art. Those who take this work will be allowed some opportunity for practice in teaching under the direction of the head of the department. I and II, 4—8.

(6) **Wood Carving and Clay Modeling**—Tools and clay provided by the department.

(7) **Applied Design**—Study of color schemes and color harmony, with historic ornament, leading up to practical designing for various handicrafts. Each student will occasionally submit original designs for embroidery, wood-carving, and other decorative work based upon natural forms. Nos. I and II are prerequisite.

(8) **Figure Study**—A life class open to all who show talent for drawing from the human form. Study of Costume.

(9) **Painting on China**—China fired in the studio. Nos. I and II are prerequisite.

(10) **Art Lectures.**—Required of pupils taking certain courses but open to all students who may wish to attend them.

Biology

PROFESSOR COOLEY.

ASSISTANT PROFESSOR SWINGLE.

MR. JONES.

Four laboratories in the experiment station building are devoted to biological work. Three of these are on the second floor and the fourth is on the ground floor in connection with the newly constructed greenhouse. This laboratory and green house combined are for the exclusive use of class in plant physiology and plant pathology and are especially constructed to that end. Both are under glass and provided with cement floors that plants may be carried from one to the other without suffering change of environment. Opening out of the physiological laboratory is a large dark room with double doors, equipped for experiments illustrating the action of light and darkness on the behavior and growth of plants.

The greenhouse is attractively furnished with plants both ornamental and illustrative; and the laboratory has aquaria in which running water keeps algae and other aquatic plants growing the year round.

The laboratories on the second floor will accommodate about fifty students, and are equipped with heavy tables with drawers. These rooms are supplied with gas and are electric lighted. Individual lockers and cupboards for the convenience of students in bacteriology, physiology and general botany and zoology are in these rooms.

Opening off the bacteriological laboratory are a culture room for transferring bacteria without danger of contamination and an incubator room where an incubator and paraffin bath are maintained at a constant temperature.

Among the more important pieces of apparatus available for work in the various branches of botany and zoology are the following: Twenty-four compound microscopes, five of which are equipped with excellent oil immersion lenses of the best makes in this country and Europe. Beside the regularly required lenses attachable to these microscopes are a fine series for special purposes, including those made especially for photomicrographic work; a Filar micrometer and several stage and eye-piece micrometers for the accurate measurement of microscopic objects; four dissecting microscopes with ratchet and pinion adjustment of the lenses of which there is a series with each instrument; twenty-two very serviceable dissection microscopes of less expensive construction; one rotary microtome for rapid and fine work; one Minot automatic precision sliding microtome especially constructed for sectioning wood and well adapted for general work; a large supply of dissecting instruments; two paraffin baths with attachments for maintaining a constant temperature; a good working set of stains and other chemicals for histological work in both animal and vegetable tissues; one incubator with constant temperature attachment, serviceable in embryological and bacteriological work; one large size eclipse type of autoclave, the most up-to-date and serviceable of any now available; one hot air sterilizer; one Koch sterilizer; one Arnold sterilizer; one Ganong clinostat; one Draper self-recording thermometer; one Draper self-recording hygrometer; six auxonometers; one photosythiscope; six warm stages.

Besides the pieces above listed the department owns a large quantity of general apparatus, glassware and chemicals sufficient for giving in a thorough manner all the sub-courses listed in this department.

It is the purpose of the biological library to furnish the students with full and up-to-date knowledge of all zoological, botanical and bacteriological subjects taught at the college, and such special subjects as may be taken up for research work.

Of the larger and more important works are Saccardo's "Sylloge Fungorum" for the identification of fungi, Engler's and Prantl's "Pflantzenfamilien," covering the entire plant kingdom; DeToni's "Sylloge Algarum" for the algae and the Kew Index and Britton and Brown's "Illustrated Flora" of North America, relating to the flowering plants, and most of the

more important classic and recent works on plant morphology, physiology and classification and on the various phases of bacteriology. There are also several hundred pamphlets dealing with special lines of botanical work, and a full set of bulletins of the state experiment stations and the U. S. Department of Agriculture, which are rich in research papers on botanical subjects.

To keep up with the most recent discoveries, we receive regularly a number of the best botanical periodicals published in this country and abroad, and we are constantly adding to our library as our special needs require.

The department is well equipped with necessary zoological literature. Special attention has been paid to accumulating titles relating to entomology and physiology, as well as general zoology. Among the more important books may be mentioned the following: Genera Insectorum (complete); Zoological Record, Entomological News (complete); Canadian Entomologist (complete); Zoologische Anzeiger, Anatomischer Anzeiger, Psyche (complete); Transactions of the American Entomological Society. Beside these are a large number of books treating of the various branches of zoological science. These, together with a large number of unbound pamphlets, constitute a good working library.

The department has purchased the entomological section of the Concilum Bibliographicum and is a subscriber to the additional cards. This catalog and one of about 35,000 references, made by the department, are of great service in facilitating the library work of the students in entomology.

A large, well-selected, and rapidly growing series of microscopical mounts, including histological preparations of animal and vegetable tissues, bacteria and dissected parts of plants and animals is available for the use of students and is of great value in their instruction.

For preparing lantern slides, prints and other illustrative material for the students, for illustrating theses and research papers and to acquaint the student with photographic methods, the biology department is provided with several good cameras. Among these are a 5x7 camera provided with a Bausch and Lomb make of the Zeiss convertible anastigmatic, series VII, a lense for general use, and a Bausch and Lomb photomicrographic outfit, including one special lense and two specially constructed microscope objectives. There are two dark rooms, one exclusively for photographic use and one in connection with the physiological laboratory used for photographic work during vacations and at other times when not in use by students in their experiments with plants. A good supply of chemicals for making the various developers, etc., is always on hand.

On the third floor opposite the museum is a well lighted lecture room which can be quickly darkened for the use of the electric lantern on a raised platform in the rear of the room. Fully one thousand lantern slides

are in the department for use in illustrating the lectures. A large part of the Kny series of botanical charts in colors and in black and white, and a series of zoological charts after Leukart are also used with the lectures.

Of the Montana collection there are about 15,000 sheets named and mounted, which includes nearly every species yet found in the state. Among these are the Kelsey World's Fair collection of 1,150 specimens; set of the Tweedy collection of Montana species; the entire Williams' Herbarium of some 1,200 specimens, exclusive of duplicates; the Rydberg-Bessey collection of about 600 specimens; the Koch Herbarium of some 1,200 specimens; the Elrod collection of 1897, containing about 225 specimens, and many smaller collections from various parts of the state. This makes it one of the most complete and valuable herbariums in the West and of great assistance in comparing specimens collected by the students or sent in from distant countries.

There are also about 5,000 from other parts of the United States and 800 specimens from abroad, and more are being obtained by exchange from our duplicate sets.

Of the lower forms our herbarium contains several hundred species collected in this state and is constantly growing in size, especially with reference to fungi of economic importance. As a broad supplement to these there are large and valuable collections of American and European mosses, lichens and fungi. Worthy of especial note is the Ellis and Everhart Columbiani, about 25,000 specimens of fungi, which is of the greatest assistance to students making an exhaustive study of plant parasites.

A large number of duplicates affords aboundant material for exchange and the use of advanced students, while the greenhouses of the biological and horticultural departments with the warm springs about Bozeman offer a great variety of living plants, both higher and lower, for winter use in the laboratories.

A collection of vertebrate and invertebrate animals has been brought together for illustrative purposes in lecture work and for general museum purposes. The collection contains a series of skeletons of vertebrates, some of the commoner small animals, mounted, one puma, about one hundred and twenty-five specimens of bird skins, a small collection of reptiles and amphibians and a good collection of invertebrate forms in alcohol and formalin. The insect collections number about 30,000 specimens accumulated from all parts of the state. From these a systematic collection is being built up which now numbers about 2,700 named species.

(1) **Invertebrate Zoology.**—Devoted to a study of the invertebrate animals, including their morphology, development, habits, economic or of popular interest, and classification. The broad biological principles are brought out and emphasized. The class room work is based on Weysse's

NATURAL HISTORY MUSEUM.



EXPERIMENT STATION.

"Synoptic Text Book of Zoology." The laboratory exercises include a study of the morphology of types, reference reading and practical work in the classification of animals. Required of agricultural students and general science students except those in the mathematics and physics group. Class room exercises by Prof. Cooley. Laboratory work direct- by Mr. Jones. I. 5.

(2) **Vertebrate Zoology.**—A continuation of (1) taking up vertebrate (chordate) forms. Required of agricultural and biology students. Elective for those who have taken (1). II, 4. Mr. Jones.

(3) **Animal Physiology and Histology.**—The student is required to prepare for microscopical study a series of tissues taken from the bodies of freshly killed animals and these slides, together with a large series owned by the department, form the basis of an extended study of animal tissues. By a series of lectures, supplemented by reading courses, the student is taught the main facts of animal physiology. Required of agricultural and biology group students. Elective for general science and domestic science students. II, 4. Prof. Cooley and Mr. Jones.

(4) **General Entomology.**—Lectures on the morphology, metamorphoses and classification of insects and a study of the different orders. Collecting, naming, labeling and arranging in museum form species that are to be found in the vicinity of Bozeman. Required of biology group students. Elective for others who have taken (1). Two lectures and two laboratory exercises per week. I, 4. Prof Cooley.

(5) **Economic Entomology.**—A briefer account of the structure, metamorphoses and classification of insects followed by an extended study of the general principles underlying insect depredations together with an account of the more important insect pests of the garden, orchard and farm in Montana. Required of agricultural students. Three lectures and one laboratory exercise per week. II, 4. Prof. Cooley.

(5) **Advanced Entomology.**—This course is a continuation of the general entomology course No. (4), and is made up of reading and conference work and of laboratory exercises. Students in this course will be assigned work best suited to their special requirements. Forestry students will take up a detailed study of the insect pests of the forest, while regular biology students will be assigned more technical subjects. II, 4. Prof. Cooley.

(7) **Household Economic Entomology.**—Lectures on insect life injurious to food materials, clothing, carpets, draperies, etc. Required of college students in domestic science. Open to other lady students in the general science courses. Two lectures per week. I. 2. Prof. Cooley.

(9) **General Botany.**—Morphology, anatomy and elementary physiology of plants including life history studies of all the groups. The fundamental biological principles are here laid down, on which all higher

botanical studies are based. Required of all science and agricultural students. II, 5. Prof. Swingle.

(10) **Plant Physiology and Histology.**—Experimental work in the movement, growth, nutrition and reproduction of plants with a microscropical study of the structure involved. Must be preceded by Biology (9) and Chemistry 1 and 2. Required of agriculture and biology students. I, 4. Asst. Prof. Swingle.

(11) **Plant Pathology.**—Classification, morphology and special physiology of parasitic plants, with a detailed study of diseases of Montana plants and their control. Must be preceded by Biology (9). Required of agronomy and horticulture students. II, 4. Asst. Prof. Swingle.

(12) **Bacteriology.**—A study of the structure, life history and classification of bacteria, their growth in nutrient media, and methods of bacteriological technique. The relation of bacteria to agriculture, disease and our daily life is discussed. Must be preceded by Biology (9) or (3) and Chemistry (1) and (2). Required of agricultural and domestic science students. I, 5. Asst. Prof. Swingle.

(13) **Forest Botany.**—A thorough study of types of trees and identification by means of leaves, twigs, flowers, fruits, seedlings, etc. The ecology of woody plants is treated with especial reference to moisture and altitude best suited for growth. I, 3. Asst. Prof. Swingle.

(14) **Forest Technology.**—Gross anatomy and histology of woody stems with especial relation to the strength, beauty and quality of the wood for technical purposes. Tests of the strength of different woods and methods of cutting and finishing are studied experimentally by the students. II, 3. Asst. Prof. Swingle.

Chemistry

PROF. CHESNUT.
ASST. PROF. BURKE.
MR. HAM.

Laboratories.—With the exception of one or two small rooms, the chemistry department occupies all of the western half of the chemistry and physics building. The laboratories are all well lighted, well ventilated and are sanitary in every respect. The freshman laboratory is located on the top floor and is provided with desks for forty-eight students. Each student is provided with a desk fitted with taps for gas and water, and is also given a complete set of chemicals and apparatus which is used solely for his own work. The steam bath and sulphuretted hydrogen apparatus, which are used in common, are placed in a hood with movable sashes which is large enough also to accommodate the work of half a dozen students. To prevent the escape into the laboratory of acid

fumes or any ill-smelling vapor, students are required to carry on all work emitting such fumes in the hood. The preparation room adjoins the freshman laboratory and the organic laboratory is next to that. Both are provided with commodious ventilating hoods containing gas, water, steam baths and drying and digesting ovens for various kinds of organic work. Both are also well equipped with all of the general and much of the special apparatus and chemicals usually called for in such work. The inorganic preparations are also made in the organic laboratory which will accommodate twenty-four students. A small room separated by a sash partition from this laboratory, is used as a balance room. The quantitative laboratory, located on the basement floor, will accommodate about sixteen persons. It is fitted with desks and hoods like the other laboratories and has a special balance room adjacent.. Next to it, also, is a room facing the north, which is especially well adapted for gas analysis and all work in physical chemistry, the department being particularly well provided with the apparatus used in calibrating weights and measures and in determining molecular weights. Next to the quantitative laboratory is the assay laboratory, the furnaces of which are also used in the high temperature work necessary in the preparation of some inorganic compounds. The assay laboratory and a small room adjacent also contain a 5-horse power motor and the crushing and grinding machinery necessary in the preparation of samples of coal, grain, sugar beets, etc., for analysis. The southwestern room is used as a storeroom and co tains crude materials which are used as a source of manufactured products and for analysis. The lecture room, with adjacent preparation room, which are on the main floor, is well equipped with apparatus and the usual facilities, including a stereopticon, for illustrating the fundamental laws of chemistry and the varied reactions induced between organic and inorganic compounds, by heat, light, electricity, etc.

Library.—The chemical library on the main floor contains full sets of the American Journal of Science, Journal of the American Chemical Society, Journal of Analytical and Applied Chemistry, Berzelius' Jahrbericht, der deutsche Chemischen Gesellschaft. Besides these it also contains many of the standard reference books and special works dealing with technical subjects. There are also index volumes and card catalogs to facilitate more ready reference to the literature.

Industrial Museum.—In the principal east room of the basement floor, where the mineralogical and geological collections are located, there are also collections of chemicals and the manufactured products with samples showing the various steps used in their manufacture and purification. There is also an almost complete collection of the elements and a number of mining and metallurgical specimens including a large series of coal samples secured from various points throughout the Northwest. The col-

lection of minerals, which is largely used in connection with the lectures in chemistry, is one of the finest to be found throughout the Northwest.

(1) **General Inorganic Chemistry.**—Lectures with frequent recitations are given on the general principles of chemistry. The properties, preparation and applications of the elements and their principal compounds are studied.

The first semester will be given to the study of the non-metals and the second semester to the metals. Throughout the year lecture experiments will be performed, illustrating general principles and quantitative relationships. 2 hrs., throughout the year. Two or three sections. Prescribed, freshman year, in all courses. Mr. Ham.

(2) **General Inorganic Chemistry Laboratory.**—Accompanying course (1) is this laboratory course which comprises the preparation, physical and chemical properties, and the tests of, the principal elements and inorganic compounds. Qualitative analysis and some quantitative experiments are also included.

The first semester will be taken up with the study of the elements, the compounds, and the quantitative experiments, and the second semester with the study of qualitative analysis. 2 hrs., throughout the year. Two or three sections. Taken with (1) and prescribed in all courses. Mr. Ham.

(3) **Advanced Inorganic Chemistry.**—In this lecture course the elements and their compounds are studied more in detail than in the first course, and special attention is given to the methods of preparation of the elements, and of such of their compounds as are of commercial importance. The theory and practice of the use of acids, alkalies, salts, limes, mortars, cements, explosives, building stones, and timber preservatives are also given. 3 hrs. throughout the year. Prof. Burke.

(4) **Physical Chemistry.**—A series of lectures with recitations and laboratory practice in which the bearing of the modern principles of chemistry upon operations in the laboratory and on a larger scale in chemical manufacturing is brought out. A general survey of the subject with the special object of showing the practical application of recent chemical theories. In the laboratory practice is given in vapor density determinations and in the conductivity, freezing point, boiling point, and other methods applied to the determination of molecular weights. 2 hrs. lecture and 1 hr. laboratory first half year and 1 hr. lecture and 1 hour laboratory second half year. Prerequisite: courses 1 and 2, physics 1 a, mathematics 4. Prof. Chesnut.

(6) **Quantitative Analysis, 1.**—The work begins with a study of the balance and of the weights and measures used in analytical work, and in the construction of tables of corrections to be used in future analytical work. Simple salts of unknown composition are first analyzed, and, as the student gains in skill, he passes to subtances of increasing complexity and of percentage composition unknown to him. His results must

come within a small fraction of one per cent of the instructor's figures before they are accepted. 5 hours first half year. Prof. Burke.

(7) **Quantitative Analysis.**—An extension of the preceding course. 5 hrs. second half year. Prof. Burke.

(8) **Inorganic Chemical Preparations.**—The preparation of chemically pure laboratory reagents and other compounds including tests of the purity of the products. One lecture, one recitation, and laboratory work. I, 4. Prof. Chesnut.

(9) **Agricultural and Sanitary Chemistry.**—Lectures upon the origin, composition and physical properties of soils, the conservation of plant food and moisture, the composition of animal and vegetable tissues, the principles of nutrition, cooking, cleansing and of the disposal of sewage. 2 hrs. throughout the year. Prescribed senior year, chemistry course.

(10) **Organic Chemistry.**—Lectures and recitations, with laboratory work, on the simpler compounds of carbon. In the laboratory the student is made familiar with organic compounds and the methods of their preparation. 2 hours lecture and 1 hour laboratory, first half year. 1 hour lecture and 2 hr. laboratory second half year. Prescribed, sophomore year in the courses in agriculture and chemistry. Prof. Chesnut.

(12) **Quantitative Analysis,** 3.—The work of a semester is devoted to a study of special methods and to a comparison of different methods with reference to accuracy of results and time required in obtaining them. Volumetric and electrolytic methods will be compared with ordinary gravimetric methods. 3 hrs. first half year. Prof. Burke.

(13) **Quantitative Analysis,** 4.—Proximate organic analysis. Methods for analysis of organic compounds, such as grains, grasses, plants, milk, soils, food, paints, asphalt, petroleum and flour. 3 hrs. second half year. Prof. Burke.

(14) **Toxicology.**—Lecture with laboratory work on the nature, effect and detection of poisons and their classification. 1 hr. lecture and 1 hr. laboratory second half year. Prof. Chesnut.

(15) **Food Chemistry.**—A laboratory and lecture course designed especially for students in the junior year of the domestic science course. 2 hrs. lecture and 2 hrs. laboratory throughout the year. Prof. Chesnut.

(16) **Assaying**—An elective course in assaying is offered to seniors taking the chemistry group. Assays are made of lead, tin, gold and silver as found in various ores, and of gold, silver and lead bullion. The cyanide and chlorination processes are carefully studied during the latter part of the semester. 1 hr. lecture and 2 hrs. laboratory, second half year. Prof. Burke.

(17) **Iron and Steel Analysis.**—This work is intended to give the student a method of determining the properties of iron and steel and to show how the presence of different elements affects the strength, magnetic properties, etc. The students are given preliminary work with known

salts to develop the method of analysis after which they work upon iron and steel. 3 hrs. first half year. Elective, civil and electrical engineering courses. Prof. Burke.

(18) —**Fuel and Gas Analysis.**—A course in analyzing fuels with reference to their value as heat producers and of gases to determine the completeness of combustion. The students will first be given salts of known composition and after gaining some skill will take up the work with fuels and gases. 3 hrs. first half year. Elective, mechanical engineering department. Prof. Burke.

(19) **Blowpipe Analysis.**—Laboratory practice in the identification of the elements commonly occurring in minerals. The spectroscope is also used in this work. 1 hr. second half year. Prescribed, freshman year, in the chemistry course. Prof. Chesnut.

(20) **Advanced Organic Chemistry.**—Laboratory work in the preparation and testing of compounds of biological or commercial interest. Bio-chemical students will make a study of the carbohydrates, fats, proteids, enzymes, etc.; the others will take up the dye stuffs. 3 hrs. first half year. Prerequisites, courses 1, 2 and 10. Prof. Chesnut.

(21) **General Qualitative Analysis.**—Practice in the separation and identification of mixtures of organic and inorganic substances. 1 hr. throughout the year. Prescribed; junior year of chemistry course. Prof. Chesnut.

(22) **Teachers' Course.**—Training course for students who wish to teach chemistry. 2 hrs. throughout the year. One-half the time of the student will be spent in assisting in laboratory instruction and the other half in laboratory work. Prerequisite; Courses 1, 2 and half of 10. Prof. Chesnut and Mr. Ham.

(23) **Seminar: Abstracting.**—In order to develop in the student a habit of careful reading, each student will be required to make abstracts of articles on assigned subjects from the leading journals, and present them at weekly meetings of the students and department instructors where the topics are freely discussed. They are thus kept in touch with the progress of the science. 1 hr. throughout the year. Prof. Chesnut.

(24) **Thesis.**—In the early part of the senior year the student selects the subject for his graduating thesis. The work must include a considerable amount of original research. 2 hrs. throughout the year. Prof. Chesnut.

Domestic Science

MISS HARKINS.

MISS BALLINGER.

The domestic science class room is supplied with charts, a food museum and microscopes. It has a department library.

The kitchen laboratory is a large room provided with cupboards and conveniently furnished with tables, sinks, two ranges, an Aladdin oven, two electric stoves, Norwegian cooking box, and a good supply of cooking utensils of all kinds. Sixteen individual work tables are provided for the use of students. These tables have full equipment of cooking utensils. Opening from the kitchen is a dining room with side board well supplied with table linen, dishes and silver.

The sewing class room is furnished with large cutting tables, small sewing tables, eight sewing machines, dress forms, large mirror, dress boxes and cases for work. The domestic science rooms are fitted up in home fashion with rugs, pictures, etc. and are used for receptions, and social functions.

(1) **General Cookery.**—The object of this course is to teach plain cooking,—breads, meats, soups, salads, vegetables and simple desserts. Special attention is given to table decoration and serving of meals. Two practice hours and one demonstration each week. Required of all freshman girls. I and II, 2.

(2) **Food Principles.**—A study of the classification of foods with regard to composition, digestibility and preparation. Lectures on marketing and care of supplies. Required of all freshman girls in domestic science course. I and II, 3.

(3) **Economic Uses of Food.**—Special attention is given to the economic side of the food question. Required of sophomore girls in domestic science classes. One lecture and one laboratory period each week. I and II. 1 and 2.

(4) **Home Architecture and Sanitation.**—The surroundings, situation and plan of the house, heating, lighting, plumbing and drainage. Two lecture periods. Required of all junior girls in domestic science course. I, 2.

(5) **Home Nursing and Invalid Cookery.**—Required of all junior girls in domestic science course. II. 2.

(6) **Final Demonstration.**—Each student prepares a breakfast or luncheon for public demonstration. Required of senior girls in domestic science course. I and II, 2.

(7) **Journal Meetings.**—Topics relating to domestic science are assigned and discussed. Required of senior girls in domestic science. I and II, 3.

(11) **Sample Sketches.**—Plain and machine sewing. At least two aprons, four pieces of underwear, two shirt waists and a house dress must be completed. This work is required of freshmen in domestic science course. I and II, 4.

(12) **Garment Making.**—At least three garments, a shirt waist and a dress must be completed. Students who took sewing (11) will be expected to make more elaborate garments. Required of all sophomore girls. I and II, 2.

(13) Sewing, drafting, cutting and fitting, and dress-making. Required of junior girls in domestic science. I, 1. II, 2.

(14) **Art Needle Work.**—Required of senior girls in domestic science course. I, 2.

(15) **Dressmaking.**—During this semester the graduating dress must be made. II, 2.

(20) **Thesis.**

English

PROF BREWER.

The library has abundant equipment for all the work offered in English. There are complete standard texts of practically all the authors referred to in any of the courses. Besides these there is a fair supply of biographical, critical and historical works, sufficient for ordinary reference use. The library equipment is complete enough so that thus far students have been able to do the reading assigned without the necessity of purchasing many books.

Though many classic novels are to be found on the shelves, no effort has been made in the college library to provide current English fiction.

In all the courses in English, written work plays an important part. That this work may be kept up to a proper grade, it is announced here that in college English work no paper will receive any credit that shows notable carelessness or ignorance in elementary matters of punctuation, grammar, rhetoric, or in the spelling of common words.

(1) **English composition.**—This course is required of all freshmen. The course is almost altogether practice in various types of prose composition, narration, description, exposition, criticism, and argumentation. The class meets ordinarily once a week. The instructor from time to time meets each student for private conference about his work. I and II, 4.

(2) **Expository Composition.**—This is a course in expository writing for those students who are specializing in other subjects. Papers not extremely technical, prepared for work in other courses may also be handed in as part of the work of this course. I and II, 4.

HAMILTONIA SOCIETY.



COLLEGE CHORISTERS.

(3) **Advanced Composition.**—This is an advanced course for those who wish to study composition as a fine art. It will include a study of the historical development of English prose style and such other work as may suit the taste or needs of those who elect the course. I and II, 4.

(10) **English Literature.**—A reading course in English literature including many of the more important authors from Chaucer to the present day. A large amount of reading is required and more recommended. Written reports on the reading are frequently required. A part of the class room time may be given to critical reading of English masterpieces. I and II, 4.

(11) **English Essays.**—A study of the development of the English essay especially emphasizing those of the nineteenth century. The subjects of English 11 may be changed from year to year, to allow of its election two years in succession.

Geology.

PROF. CHESNUT.

ASST. PROF BURKE.

Nowhere in the world perhaps is there a better opportunity to study the action of forces now in operation and to apply the laws deduced therefrom to the explanation of past events than there is at Bozeman. Situated as it is in the heart of the Rocky Mountains, a vast and almost complete series of rocks ranging from the present to the remotest past, is within easy reach of the student whose work is furthermore greatly facilitated by the fact that he has at his command a series of maps, made by the expert cartographers and geologists of the United States Geological Survey which minutely describe all of the geological features of the region. In addition to the stratified rocks there is, within comparatively easy access of the college, a wide range of igneous rocks from granite and black basalt to the finest of wind-borne ashes, and also a great variety of rocks and ores formed by chemical deposit. Earth-crust fractures of profound depth have occurred within the immediate vicinity of the college and the conditions for their study are most favorable. That the field is of more than special interest is shown by the fact that some of the field work of the Harvard School of Geology is done in this vicinity.

A knowledge of geology is of great importance to all who desire a liberal education and of prime importance to engineers and scientists whose work carries them into the field.

(1) **Geology.**—Lectures, occasionally illustrated with the stereopticon, covering the work of structural and dynamical geology as presented in Le Conte's Elements of Geology and in the local folios of the United States Geological Survey. Prerequisites Courses I and II in chemistry;

Courses 1. 2 and 3 in Mathematics and course 1 a in Physics. I, 2. Prof. Chesnut.

(2) **Palaeontology.**—Lectures, occasionally illustrated with stereopticon views, covering the subject of historical geology as given in Le Conte's geology and further illustrated in the local folios. Prerequisite, Course 1 in Geology, and courses 1 and 9 in Biology. Given only in alternate years. Given in 1907-8. Short field trips are made in connection with courses 1 and 2. II, 3. Prof. Chesnut.

(3) **Economic Geology.**—Lectures are given on the following general subjects: Ore deposits, their classification, genesis and occurrence; abrasive materials; natural salts; gems; limes; cement and artificial stone; pigments; water; phosphates; clay used for pottery, porcelain, etc.; sands for glass; soils and miscellaneous topics. II. 3. Prof. Chesnut.

(5) **Elementary Mineralogy.**—Laboratory work in the identification of minerals. A part of the laboratory period is taken up in calling attention to the diagnostic value of the different physical properties of minerals and in applying them to the determination of specific minerals. Special attention is given to those properties which can easily be distinguished without apparatus but chemical tests are used to supplement the others. Each student has access to the extensive mineral collection of the college and each determines, independently, a representative set of minerals of agricultural and economic importance. The relation of minerals to rocks and to soil fertility is also pointed out. II, 2. Prof. Chesnut.

(6) **Meteorology (Elementary Course).**—This course will consist of lectures, supplemented by a study of the meteorological apparatus in general use, and the method of keeping records.The lectures will include a study of the earth's atmosphere; its composition, temperature, pressure and circulation. The moisture of the atmosphere, dew, frost, clouds, and rainfall, storms, cyclones, tornadoes, and thunderstorms. II, 3.

Assist. Prof. Burke.

History.

MISS BREWER.

The department has a set of MacCoun's historical charts of the United States and two sets of historical geography charts of Europe by the same author: Johnston's series of maps of ancient geography: ten of Bretschneider's maps of medieval Europe; and a set of maps of the modern world.

The library contains the laboratory of the historical department but a catalog of the histories would be too voluminous to include here. In Greek and Roman history besides the standard narrative works there are translations of the best source material for this period. For English his-

tory the library is well equipped with general works and has source material including Colby, Lee, and the University of Pennsylvania collection, Evelyn's Diary, a file of "The Gentleman's Magazine", etc.

Naturally the works on the United States history are most numerous. The standard general histories, as well as works on limited periods or regions and the best biographies of American statesmen are in the library. The reports of the American Historical Association, and the Congressional Records come to the library. There are also many contemporary records among which are the Old South Leaflets, Hart's American History Told by Contemporaries: the complete works of Jefferson, Hamilton and other statesmen, and the Jesuit Relations.

(1) **European History.**—It is taken for granted that the student has had a preparatory course in general history, with some such text as Myers or West. In this course special attention is paid to English history and the student's work is supplemented by lectures on the development of continental Europe. Cheyney's History of England and Kendal's Source Book are texts in the hands of the class, and special topics with library references are occasionally assigned. I and II, 4.

(2) **Medieval History.**—The student is supposed to have had courses which have given him knowledge of the great epochs in history and their relations to each other. Therefore, in this course he will take up the thorough study of one period. He will be encouraged to form his own opinions by the use of such historical sources of this period as are available in translations. In this connection the student will be given practice in application of the fundamental rules used in testing the value of historical material. I and II, 6.

(5) **American History.**—This is a course in United States history covering the period of constitutional development and with special reference to that development. The use of the library rather than any textbook is required in this course, and the student is expected to spend about one-fourth of the time in the preparation of a paper on some selected subject. Course 2 should precede this course. I and II. 6.

(6) **Thesis.**—For research work in his senior year the student is allowed to select any historical subject which he is qualified to investigate; and for which some material is available either in translation or original.

Latin.

PROF. BREWER.
MISS BREWER.

(1) **Cicero.**—The four orations against Catiline are read, and two others. Roman politics, as compared with those of our day, always interest students who have an intelligent interest in current events, and there is every opportunity for such comparative study in this work. I and II, 8. Miss Brewer.

(2) **Virgil.**—Five books of the Aeneid are read. Metrical reading of Latin is required constantly. The students are encouraged to make metrical translations and paraphrases. I and II, 8. Prof. Brewer.

(3) **Livy and Horace.**—The special aim in this year's work, as in the previous course, is to enable the student to acquire facility in reading and to instruct him in the use of Latin texts as a means of acquiring knowledge of the public and private life of the Romans; but grammatical study and literary criticism will not be neglected. I and II, 4. Prof. Brewer.

Mathematics.

PROF. TALLMAN.

The students of this department have access to the following journals: American Journal of Mathematics (complete set), Annals of Mathematics (from 1900), Bulletin of American Mathematical Society (1898 to date) and Transactions of American Mathematical Society (1898 to date), also about 200 volumes of recent treatises on mathematics. It may also be mentioned that our library is especially well equipped in treatises and journals of applied mathematics found in the libraries of the engineering and physics departments.

(1) **Algebra.**—Beginning with a review of radicals and quadratic equations, the course includes progressions, arrangements and groups, binomial theorem, theory of limits, undetermined coefficients, logarithms, and an introduction to the theory of equations. I, 3.

(2) **Plane Trigonometry.**—For engineering and science students. I, 2.

(2a) **Plane Trigonometry and Logarithms.**—For agricultural and domestic science students. I, 3.

(3) **Analytical Geometry.** Straight line and conic sections, with an introduction to the geometry of three dimensions. II, 4.

(4) **Calculus.**—Both differential and integral with applications to as many practical problems as possible. I and II, 10.

(5) **Method of Least Squares.**—I, 2.

(6) **Theoretical Astronomy.**—Integration of equations of motion, computation of orbits and ephemerides. This course should be preceded by course (5) in physics and must be preceded by course (4) in mathematics. II, 3.

(10) **Differential Equations.**—Ordinary and partial differential equations with geometrical and mechanical applications. I and II, 6.

(11) **Partial Differential Equations of Mathematics-Physics.**—This course will be based on Weber's "Die Partiellen Differential Gleichungen der Mathematischen Physik" and Byerly's "Spherical Harmonics." A great many applications to concrete problems will be made throughout the course. I and II, 6.

(12) **Newtonian Potential.**—Lectures on the theory of potential with an introduction to spherical harmonics. I and II, 4.

(13) **Algebra (Advanced).**—This course will be an extension of course (1), and will contain discussion of complex numbers, theory of algebraic functions, etc., care will be taken to show the practical application of each subject as the work advances; that is, such subjects as the connection between complex numbers and alternating currents, etc., will be fully explained. I and II, 6.

(14) **Analytical Geometry (Advanced).**—This course is a continuation of course (3). As the time given in course (3) for geometry of three dimensions is very limited it will receive considerable attention in this course. I and II, 6.

(15) **Thesis.**—Students in the mathematical group are required to present a thesis on some chosen subject. The subject must be chosen and approved not later than November 15 of the senior year. A great deal of work in this line is desired, as it is believed there is no better way of developing a habit of independent thought.

(16) **Mathematico-Physical Seminar.**—During the year students and members of the faculty, especially interested in these subjects, will meet once a week to review articles of interest in the current magazines, to present from time to time results of original research which is being carried on, etc. Students in the mathematical group are required to attend.

Only a selection of courses (10) to (14) will be given each year, those being chosen for which most students apply. The special object of our work here is to make the courses in applied mathematics complete, and the work in pure mathematics will have as its object the laying of a good foundation for the more advanced work in applied mathematics. Those desiring to do work which is not offered in the above courses may consult the professor in charge of the department.

Modern Languages

PROF. CURRIER.

MRS. HALL.

The modern language department is well represented in the college library. The list includes the standard works in German and French literature in the original, as well as complete translations of the more important writers.

Many works of historical and critical nature and a number of standard lexicons may also be consulted. Several foreign language periodicals are at the disposal of students.

(1) **French.**—The study of French is begun in the freshman year, and the first year's work includes a thorough study of the elements of grammar, careful reading, with translation of 300 pages of easy French, composition, practice in pronounciation and oral reading. Fair facility in sight reading is expected at the close of the year. I and II, 8.

(2) **French.**—In the sophomore year, in addition to easy texts and further study of grammar and composition, the classics, prose and poetry will be read, and also some scientific French, thus cultivating in the student an appreciation of the best foreign literature. The chief aim of the course is the acquisition of practical reading knowledge. I and II, 6.

(3) **French.**—An elective course in the French classic drama and nineteenth century fiction is offered to juniors and seniors. I and II, 6.

(10) **German.**—This course is open to college students who have not had high school or preparatory German. The work of the first year includes careful study of the elements of grammar, composition, pronounciation, conversation, the reading of easy texts, and sight reading. I and II, 8.

(11) **German.**—A continuation of above course. The work consists largely of reading of a practical nature, with some introduction to the classics. Further attention will be paid to grammar and composition. If requested, scientific German will be read. I and II, 8.

(12) **German.**—The freshman work in German is a continuation of the course offered in the preparatory department, and can be taken only by students who have had two years of German previously. The classics will be studied; also, scientific texts if desired, and some attention will be given to composition and conversation. I and II, 8.

(13) **German.**—An elective course offered to those who have completed course 11 or 12. If consists chiefly of advanced reading of a practical, scientific or literary character, as the needs of students electing it may dictate. I and I, 4.

Philosophy and Economics

PRESIDENT HAMILTON.

(1) **Psychology.**—This course presents a general view of modern psychology and is required of all general science students. It gives a practical exposition of the materials and methods of psychological investigation. The lectures are accompanied by class demonstrations. Attention is given to such topics as the growth of the central nervous system, the nature of consciousness, sensory and motory training, the higher intellectual faculties and the will. So far as possible the work is made practical and concrete. I, 3.

(2) **Ethics.**—The work in ethics includes a study of the evolution of conduct, moral standards, the social and industrial life, the development and trend of ethical thought and an examination of utilitarianism. Required of general science students. II, 3.

(3) **Economics.**—This course consists of a study of such questions as land, capital, labor, money, coinage, banking, rent, interest, wages and taxation. The most important questions in economics of the present time are considered. Among these may be mentioned trusts, labor organizations, government ownership of public utilities, co-operation, recent currency legislation and the single tax. Required of general science students. I and II, 4.

(4) **International Law.**—Woolsey's text book is used, but is supplemented by lectures and library work. In addition to the study of the principles of international law, an examination is made of treaties and the findings of international congresses. A practical study is made of the important questions in which our own government is especially interested, such as the Monroe Doctrine, the Eastern question, international arbitration, etc. Elective II, 3.

Physics

PROF. COBLEIGH.

The science of physics is fundamental to many of the technical studies taught in the college. Therefore the chief purpose of the following physics courses is to provide a thorough training in the science itself and in the use of the scientific method of thought, to the end that the student may have an adequate preparation for the study of the technical subjects in agriculture and engineering which are based on physical principles. The applications of the science are taught in so far as they do not interfere with the main purpose stated above.

The facilities at the disposal of the physics department are given below somewhat in detail.

The lecture room is located in the basement of the chemistry and physics building. The lecture desk is supplied with gas and both alternating and direct current circuits. A projection lantern is permanently set up and is used constantly to illustrate the class room exercises. A large collection of lantern slides has been prepared, which cover the whole subject of physics. The apparatus for lecture demonstration has been carefully selected and is sufficiently complete for giving experimental illustrations of all the principles of the science that are usually included in college courses.

For laboratory instruction three well lighted and conveniently furnished rooms are provided on the second floor of the building.

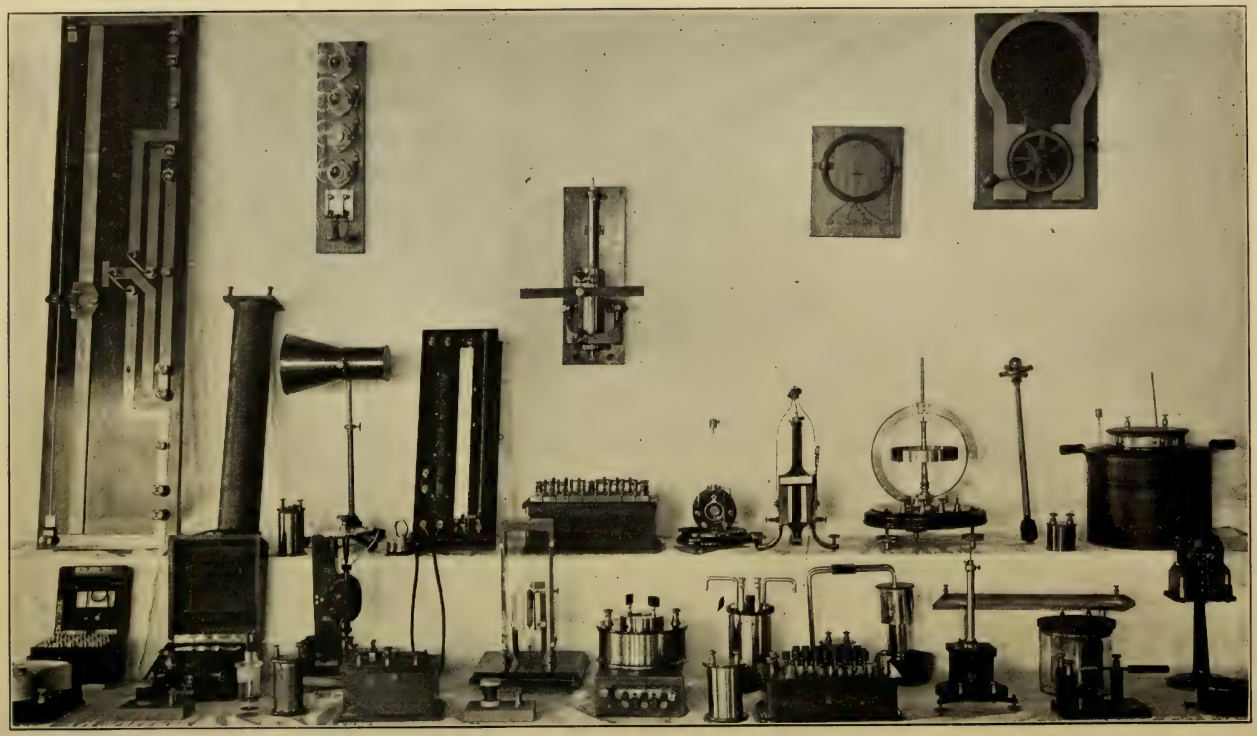
One of these rooms is equipped for electrical measurements and is wired with both alternating and direct current circuits, conveniently arranged for experimental purposes. The galvanometers are permanently located in convenient positions; the following forms are available: tangent, astatic, Thompson, differential, Northrup, and seven forms of the D'Arsonval type including two with ballistic suspensions. In addition to the above equipment the following instruments are used in the various experments taught, viz: magnetometer, standard resistances and condensers, Carhart-Clark cells, wire and box forms of the Wheatstone bridge, Carey Foster bridge, rheometer, electro-dynamometer, ammeters, voltmeters, Leeds' potentiometer, platinum thermometer, thermocouples, earth inductor, standard solenoid and rings of iron wound with wire for experiments in magnetization and hysteresis..

The second laboratory is furnished and equipped for teaching mechanics and heat. The equipment includes the following: micrometer and vernier gauges, spherometer, cathetometer, balances and weights, hydrometers, Atwood's machine, Young's modulus apparatus, torsion apparatus, torsion pendulums, apparatus for resolution and composition of forces, impact, harmonic motion, principle of moments, centrifugal force, and surface tension; simple and Kater's pendulums, a laboratory clock, thermometers, air thermometer, calorimeters, expansion apparatus, hygrometers, Searles' mechanical equivalent of heat apparatus.

The third laboratory is used for the study of light and sound and also for the elementary classes in the preparatory schools. The equipment for teaching light and sound includes the following: a photometer, two spectrometers, spectroscope, mirrors, prisms, lenses, diffraction gratings, optical bench, Fresnel mirror and bi-prism, apparatus for polarized light, microscope, telescopes, and an Abbe refractometer, sonometers, Kundt's tubes, siren, Lissajous apparatus and Helmholtz resonators.

For the study of radioactivity and allied phenomena, there is a large induction coil, a variety of Crookes' and X-ray tubes, Wilson electroscope, radium compounds and other radio-active material.

The physics library is located in one of the laboratories for students'



ELECTRICAL APPARATUS.



LABORATORY FOR PLANT PATHOLOGY.

use. It contains many of the best text books and general works on physics and the current numbers of the Philosophical Magazine, the Physical Review, Science Abstracts, Section A, and School Science and Mathematics.

(1a) **General Descriptive Physics.**—Two lectures and laboratory work two and one-half or five hours per week in mathematics, heat, electricity, sound and light. Physics (1a) is a prescribed study in the courses in agriculture, biology, chemistry, domestic science, and history-literature. Mathematics (2) is prerequisite. Textbooks, Physics, by Mann & Twiss; Laboratory Course, by Sabine; Laboratory Physics, by Miller. I and II, 6 or 8.

(1) **General Physics.**—Lectures, recitations and assigned problems three hours per week throughout the year on mechanics, heat, magnetism and electricity. This course is more mathematical and technical than physics (1a) and is particularly designed to meet the needs of students in engineering and the science students in the mathematics-physics course. Students who have not completed the calculus, mathematics (4), are required to take it during the same year that physics (1) is taken. Textbook, General Physics, by Hastings & Beach. I and II, 6.

(2) **Physical Measurements.**—A laboratory course designed to supplement physics (1). It is strictly quantitative and is given for the purpose of providing laboratory illustrations of fundamental principles of the science and to offer a training in making measurements of precision. In order that the student may determine the precision obtainable in the various experiments of this course the first four weeks will be taken up with lectures on the nature of experimental errors, methods of their elimination and the precision of measurements. The calculus will be used in the solution of precision problems that arise in the experiments of the course. Textbooks, Mechanics, Molecular Physics and Heat, by Millikan; Laboratory Physics, by Miller. I and II, 4.

(3) **Light and Sound.**—Lectures and recitations two hours per week on wave motion, the theory of light in its application to familiar optical phenomena and to optical instruments and the phenomena and laws of sound. Prerequisites, physics (1) and (2). Textbook, General Physics, by Hastings & Beach. II, 2.

(4) **Physical Measurements.**—A laboratory course in light and sound to supplement physics (3). II, 2.

(5) **Electricity and Magnetism.**—Lectures, recitations and problems, two hours per week on the mathematical theory of selected portions of electricity and magnetism, electrical units and exact methods of measuring electrical quantities. Physics (1) and (2) are prerequisite. I, 2.

(6) **Electrical Measurements.**—A laboratory course supplementing course (5). It consists of exact measurements of resistance, electromotive force, current, capacity, and self-induction, calibration of commercial

measuring instruments, insulation tests, battery testing, and magnetic measurements, including determination of the permeability and hysteresis of samples of iron. Requirements are the same as for course (5). I, 2.

(7) **Advanced Physics.**—Physics (7) is primarily a laboratory course and is offered as an elective to science and engineering students. Conferences and assigned reading are essential features of the course. A more complete study of the precision of measurements will be made than was attempted in physics (2) and a precision discussion will be a required portion of each laboratory report.

There are four separate parts to this course from which the work desired may be selected.

(a) **Heat.**—A study of exact methods of thermometry, pyrometry, calorimetry and determination of the mechanical equivalent of heat. Physics (1 and (2)) are prerequisite. I or II, 3.

(b) **Light and Radioactivity.**—Conferences, assigned reading and a series of standard laboratory experiments to illustrate diffraction, interference and polarization of light, spectroscopy, photometry, conduction of electricity through gases, and the phenomena of radioactivity. Physics (3 and 4) are prerequisites. Not offered in 1907-8. II, 3.

(c) **Electricity and Magnetism.**—This course will be arranged to suit the needs and purposes of individual students. It is offered as an elective in the science and electrical engineering courses to those who wish to continue the subject beyond the requirements of physics (5 and 6). I or II, 3.

(d) **Manipulation and Construction of Apparatus.**—This is primarily a course in processes useful in the laboratory and includes glass blowing, cutting, grinding and polishing, preparations of fibres for suspensions, silvering glass, purifying mercury and photography, including copying, printing and lantern-slide making. Practice is given in the construction, and setting up of apparatus suitable for both elementary and college courses in physics. In this connection there will be conferences and assigned reading on the more recent methods of teaching high school and college physics. Physics (1, 2, 3 and 4) are prerequisite. I or II, 3.

(8) **Thesis.**—Students in the mathematics-physics group who elect physics as their major subject, are required in the senior year to prepare a graduating thesis on some subject which will involve considerable laboratory work and as much originality as possible.

Political and Social Science

PROF. BREWER.

For these subjects the library has a fair supply of the best reference books and material is available also from the best current periodicals, from bound sets of several magazines, and from the government reports, both state and national.

(1) **Constitution of the United States.**—One semester is given to the study of Bryce's American Commonwealth. The aim of the course will be to give a clear idea of the present day working of our government, and the problems that confront it; and to study intelligently contemporary questions of public life. II, 2.

(2) **Sociology.**—The origin and history of human society, the various social theories and the laws of human intercourse are treated. Attention is given to such practical subjects as the government of cities, settlement work, the enrichment of country life, and charity work. Elective, I, 3.

Public Speaking.

MRS HALL.

Two hours a week throughout the year are devoted to the study of vocal expression and practical public speaking. A few recitation periods are given to a review of parliamentary law as a practical aid to all platform work.

Original material is required in extemporaneous speeches, debate and formal address.

The principles of artistic interpretation and platform oratory are developed by the study and presentation of literary masterpieces. In addition to this required classroom work, students receive individual training from the instructor in public speaking and intercollegiate debates, oratorical contests, dramatic recitals and plays.

School of Music.

FACULTY.

F. ARTHUR OLIVER, Director.*
Teacher of Piano and Harmony.

MISS ARABELLE U. BARNES, Acting Director, 1907-8.
Teacher of Piano and Harmony.

MISS REGINA BARNES.
Instructor in Piano Department.

MISS PHYLLIS P. WOLFE,
Instructor in Vocal Department.

GEORGE W. HEY,
Instructor in Violin Department.

ADVANTAGES OF COLLEGE INSTRUCTION.

The advantages of college over private instruction are very numerous and quite obvious to anyone giving the matter serious thought. When a student is seeking the services of a private teacher he must form his judgment as best he can on that person's fitness for his vocation, while it is certain that the teachers of a successful college, are selected mainly on account of their ability, as it would not be in the best interests of such an institution to sacrifice its reputation by employing other than good teachers. Again, the stimulating atmosphere of a music school is another distinct advantage over private instruction.

The Music Departments are organized for a four-fold purpose:

1. To combine musical and literary studies as a broad basis for regular collegiate instruction.
2. To use the art of music as a means of intellectual, aesthetic and moral culture.
3. To teach all branches of music to special and general students.
4. To educate teachers of music.

DEPARTMENTS OF INSTRUCTION.

I. Course for the Pianoforte.
II. Course for the Voice.
III. Course for the Violin.
IV. Course for Harmony, Counterpoint, Analysis, and History of Music.
V. Chorus and Orchestral Instruction.

* On leave of absence in Europe, 1907-8.

No time limit can be designated for the satisfactory completion of any course on account of differences in degree of musical ability; much also depends on the preparation made and upon the amount of time and careful attention the student can devote to the pursuit of a chosen study.

Students who present themselves as candidates for graduation, must give evidence of requisite musical talent and capacity. Each student must give, during the last year of study, at least one public recital, in addition to the final performance at the commencement concert. Students in their graduating year are required to take two private lessons a week. To prepare for graduation, it is necessary that resident students should study with teachers of the college for at least two years. For graduation two years work in harmony will be required and one year in the history of music.

In the piano course, special attention is paid to excellence of technique, accuracy in study, touch and phrasing, use of the pedal, balance of tone between melody and accompaniment and in part playing, playing at sight and from memory.

The study of music has recently been placed on an equality with other elective studies in the general science course and a limited number of credits may be counted toward a degree. Diplomas will be granted to students who have done satisfactory work and passed the required examinations.

PIANO DEPARTMENT.

FIRST GRADE.

Fundamental technique, selections from the five-finger exercises of Biehl, Vogt, and Mason. All minor scales, four octaves, hands separately; triads in all minor keys; Matthews' graded courses; Duvernoy op. 176, Lemoine op. 37 Bk. I, selections from easy sonatinas and selected pieces.

SECOND GRADE.

Five-finger exercises, transposed in all minor keys, major and minor scales, hands together, legato and staccato. Major and minor chords in triad and four note form, all with inversions, solid and broken. Czerny-Germer studies, Vol. 1 first part; Koehler studies, op. 50; studies by Franklin Taylor and other elementary studies. Clementi and Kuhlau, Sonatinas; Bach, Twelve Little Preludes. Suitable pieces will be selected by the instructor.

THIRD GRADE.

Five-finger exercises continued; major and minor scales, hands together, parallel and contrary motion in quarter, eighth and sixteenth notes. Triads and four-note form chords, with different touches; also

the dominant seventh chords. Germer studies, Bk. II; Heller studies; Duvernoy, op. 120; studies by Franklin Taylor; Bach, Two Voice Inventions. Sonatinas and sonatas, and selected pieces from the classics.

FOURTH GRADE.

Daily technique studies; all major and minor scales in octaves, tenths, sixths and thirds; and also in various rythmic forms. Triads and four-note form chords; chords of the diminished seventh with inversions. Arpeggios formed on the major and minor chords, on the dominant seventh and on the diminished seventh, with their inversions. Octave studies; Heller studies, advanced grades; Hassert op. 50 Vol. 1 and II; Clementi, preludes and exercises; Bach, preludes and fugues; Carmer-Buelow studies; Loew octave studies; Sonatas by Beethoven, Haydn, Mozart. Selections by Bach, Mendelssohn, Schubert, Schumann, Liszt, Chopin, Grieg and others.

FIFTH GRADE.

Advanced technique studies and Pischna exercises. All major and minor scales in octaves, tenths, sixths and thirds; in crescendos and diminuendos; two notes against three; three notes against four; scales in double thirds and sixths. All chord forms, solid and broken. Arpeggios formed on all major and minor chords, also on dominant seventh and diminished seventh thirds with their inversions; octaves with any variety of touch required. Bach, Well Tempered Clavichord; Clementi, Gradus ad Parnassum; Moscheles, op. 70 and selected studies, by Chopin, Henselt, Haberbier, and Liszt; Kulak, octave studies, Bk. II; Sonatas; Concertos by Beethoven, Mozart, Mendelssohn and others. Miscellaneous classics and selections from modern composers.

TUITION.

(Payable in Advance.)

WITH MR. OLIVER.

For one forty-five minute lesson per week, for one semester.....$26.00
Two half-hour lessons per week, for one semester..... 35.00

WITH MISS BARNES.

One forty-five minute lesson per week, for one semester.....$18.00
Two half-hour lessons per week, for one semester..... 26.00

Piano rent.—One hour each day, 30 cents per week.

Regulations.—No reductions will be made for temporary absence from lessons, or for lessons discontinued. Lessons missed by the teacher will be made up at the mutual convenience of teacher and pupil.

The department is closed on the college and national holidays. Lessons falling on these days will not be made up.

HARMONY AND HISTORY.

For the two years' work required for graduation, Jadassohn's and Banister's Manuals of Harmony are used. A thorough drill is also given in notation—notes and rests, the staffs, clefs and ordinary musical signs; intervals, time, scales, transposition; and definition of musical terms. Students are trained to play cadences, sequences and modulation upon the piano. Matthews' Popular History of Music will be used for one year.

Fees.—$15.00 for the entire academic year, (one lesson a week).

DEPARTMENT OF VOCAL MUSIC.

The formation and development of the singing voice will be carried forward by the adoption of what are believed to be the best features of several methods, as well as by the use of discriminating judgment as to any particular needs of the particular voice under treatment. Special attention will be given to breath control and tone placement; the proper use of the muscles of the throat and tongue. An effort is made to secure good pronounciation, enunciation, correct phrasing and expression.

For the first year's work studies and vocalizes from the following composers will be studied: Sieber, Marchesi, and Abt. Also songs suited to the singer by Cowen, Tosti, Mercedante, Miliotte, and others. In the second year more difficult studies and vocalizes from Leutgent, Concone and others will be taken up, with more difficult songs by Mozart, Handel, Pinsuti, Gounod and many others. More difficult studies and songs will be used in the third and fourth years.

An exact schedule of work cannot be given, as each singer has different needs, but care will be taken to choose such work as will best fit the needs of the pupil.

TUITION.

(Payable in Advance).

One forty-five minute lesson per week for one semester.....$22.00
Two half-hour lessons per week for one semester..... 32.00

Pupils wishing to arrange for instruction by the single lesson instead of by the semester will be charged $1.50 per lesson.

No reduction will be made for any pupil who enters late in the term, or for temporary absence, or for withdrawal before the end of the term. In case of protracted illness, arrangements may be made at least a day before the lesson period.

VIOLIN DEPARTMENT.

For beginners the First Part of the Violin Schools by either Louis Schubert, Carl Henning, Edm. Singer, or Herman, is used, and, when necessary, there are introduced easy arrangements of melodious pieces for violin

with piano accompaniment, such as Melodien Sammlung, by H. Urban, etc., selections from easy duets for two violins, by Pleyel or Mazas. This is followed by Part II of Henning's Violin School; Kross' scales in two octaves; Studies, by H. E. Kaysor, op. 20, or first part of Gradus ad Parnassum, by Jacques Dont; and easy solos, by Allard, Hermann, de Beriot and others. Compositions for violin and piano are introduced as soon as practicable. Selections from the following are made according to the ability of the student: Dussek's Sonatas for piano with added violin part; sonatas for piano and violin by F. Schubert, Hauptmann, Haydn, and Mozart; Beethoven's Serenade op. 8, arranged for piano and violin, etc. Later, Part III of Henning's Violin School; Scales in Three Octaves, by Fischel; Schradiesek's Violin Technic and Tonleiterstudien; the studies of Kreutzer, Fiorillo, Rovelli and Rode; Concertos, by Viotti, or Rode; Solos, by David, Allard, De Beriot; Duettos, by Viotti or Spohr. Lastly the 24 Etudes, by Gavine, Alard's 10 Etudes Artisiques op. 19, and Abel's adaption for the violin of Cramer's Famous Piano Studies; Concertos, by Mendelssohn, Beethoven, Spohr, Molique and Max Bruch; Sonatas for the violin, by Bach; Solos by Vieuxtemps, Ernst, Wieniawski, Saraste and other modern composers.

Material for violin department can be obtained from Prof. Hey.

ENSEMBLE.

In this department, Sonatas for piano and violin by Bach, Beethoven, Mendelssohn, Schumann, Mozart, Haydn, Schubert, Grieg, Rubinstein and others are used; also many classical compositions of different forms. This department is open to advanced piano students only.

TUITION.

(Payable in Advance.)

One hour lesson per week, for one semester	$35.00
Two half hour lessons per week, for one semester	35.00
One forty-five minute lesson per week, for one semester	26.00

Terms.—For ensemble with violin same as for violin lessons.

Regulations.—Same as for piano department.

RECITALS.

Frequent piano and vocal recitals are given both by members of the faculty and students, the latter being thus enabled not only to cultivate their taste by hearing the best composers interpreted by the advanced students, but to develop their own powers of performance to the fullest extent.

Pupils studying in the elementary grades, are encouraged to play at

SEWING ROOM.



ART CLASS.

the junior recitals, as soon as they are grounded in the primary requirements of touch, phrasing and conception.

The director will be pleased to make appointments for consultation with any students who contemplate entering for a course of study.

Ensemble Class.—At the beginning of each year, ensemble classes are arranged. Students will find these classes very desirable and helpful, not only because they afford an opportunity of becoming better acquainted with the literature of concert music, but also because they insure a steadiness in playing and inspire confidence.

Oratorio Society.—This organization of Bozeman, under Prof. Oliver as musical director, has included many students of the college musical departments and will continue to admit those who are qualified and desirous of entering. The society has a membership of about seventy-five and has been in existence for five years.

College Choristers.—The glee club consisting of twenty members was organized two years ago by Mr. Oliver. Students who have suitable voices for singing and who read music with sufficient facility are admitted. The choristers give an annual concert.

College Band.—A band of twenty pieces under the instruction and leadership of Mr. Louis Howard affords ample opportunity for all students who desire training in clarinet, cornet, trombone, French horn, and other band instruments. In addition to private and ensemble instruction, extensive practice is given in concerts and on public programs at college functions.

School of Art.

MRS MARSHALL.

MRS. GAGE.

The art department has a good equipment of casts in busts, masks, parts of the human figure, ornament and geometric solids; benches and tools for wood carving and clay modeling, a kiln for china-firing, a perforating machine for transfering designs for embroidery, and photographic copies of sculptures and world pictures. There is also a splendid selection of books on art.

This work is intended to famaliarize the student with the principles that underlie art, as well as with the practice of the various forms of art chosen accoding to the taste of the student. Lectures are given on the principles and history of art, but the teaching is entirely individual. Among the forms of work offered are drawing, with attention to grouping, light and shade, perspective; clay modeling, wood carving, decorative designing, china painting, art embroidery; painting in oil or water colors, sketching from nature, figure study.

That the study of drawing is important in education is now universally acknowledged. Aside from the advantage to engineers, machinists and architects, of a practical knowledge of draughtsmanship, the psychologic value of a knowledge of drawing is very great. The chief object of education is the quickening of the powers of the mind. Drawing brings out the power of analysis, habits of observation, qualities of judgment, imagination, memory and taste. It is something more than mere training of the eye. To achieve even moderate success requires that thought be put into every line. A line put down without thought is always a wrong line.

Art aside from anything we can produce, helps us to appreciate the works of great artists and opens our eyes to the beauty of form and color in nature. It extends our powers of enjoyment and gives us a better understanding of the history of the human spirit. It gives us a proper gratitude for the work of great artists.

Students who are registered in the art course are admitted without further tuition fees to such other work of the college as their preparation will permit them to pursue to advantage. Attention is called in this connection to the work offered in history, literature, language, domestic science, music (which is charged separately) and in engineering and mechanic arts.

The art course, as here outlined, will indicate the work of the average student in a four year's course planned for those who attend mainly for the art work. All the teaching being individual, the student is carried forward just as rapidly as his own talent and industry will permit.

Every effort is made to teach correct drawing. The pupil is then encouraged to apply such knowledge in any direction in which his talents may seem to lie, and is allowed the use of various mediums, such as oil, water color, pastel, etc., and also may take lessons in china painting. The classes in drawing and wood carving are open to students in any of the college courses.

FRESHMAN YEAR.

Drawing.—Drawing from the cast, in charcoal or crayon. Still life and object drawing. Drawing from plants and other natural forms in preparation for design. Sketching from nature, in the last few weeks of the second semester. In object drawing the pupil is required to study artistic grouping and good arrangement of light and shade. Memory and time drawing and blackboard work will be carried through the year.

Perspective.—Perspective and its practical application to the drawing of buildings and to sketching from nature. Perspective problems to be worked out and carefully drawn. Water color tinting for mechanical work. Several art lectures each week. Clay modeling may be studied at the discretion of the teacher.

SOPHOMORE YEAR.

General Principles of Design.—Color schemes and color harmony. Historic ornament. Each student will occasionally be required to submit original design for embroidery, wood carving and other decorative work based upon plant forms which he has drawn during previous years.

Painting.—The painting of plants and still life in oil or water color. Pen and ink drawing. Sketching from nature as the weather will permit.

JUNIOR YEAR.

Wood Carving.—An extended course in carving as applied to furniture and other objects. Lectures on the history of wood carving.

Figure Study.—In this year there is a life class, open to all who show talent for figure drawing. Study of costume. Painting in oil and water. Lessons on decoration of interiors.

SENIOR YEAR.

Any branch of art preferred by the student. Otherwise further instruction in branches already begun by the student. China painting if desired.

The Preparatory School.

MISS MARY A. CANTWELL, Principal.

The preparatory school is maintained for the benefit of the young people who live in counties not having high schools, or in the rural districts not convenient to the city high schools. In addition to the usual high school course, two complete industrial courses are offered, one for boys and one for girls. With the large and well equipped kitchen, sewing rooms, shops and laboratories, this work ranks with that of the best secondary industrial schools. Many members of the college faculty give preparatory instruction in their special subjects.

Three courses are provided—the academic, the manual training and the domestic science. The academic course requires Latin or German for the last two years; while the other two substitute for the language the special subjects, manual training and domestic science, respectively. Students who undertake the academic course must carry the language for two years to receive credit. Each of these courses prepares for any one of the college courses. They furnish a fair training to those whose circumstances will not allow them to take a regular college course and are also helpful to those qualifying themselves to teach.

For admission to the preparatory school the equivalent of an eighth grade certificate is required. Those not having eighth grade certificates will pass an examination in the common branches, or otherwise satisfy the principal before entering classes.

Military drill is required of the men and physical culture of the women.

A liberal course of reading is given in English classics during the course as a part of the required work. It is desirable so far as possible for students to purchase the books and make them a part of their private libraries.

Judge F. K. Armstrong of Bozeman gives a prize of ten dollars to the one taking first place in an annual declamatory contest. There is also a prize of five dollars for the second best. Only regular students in the preparatory school are eligible to enter this contest.

Those who complete the course satisfactorily are granted suitable diplomas.

PREPARATORY COURSES

FIRST YEAR.

English Composition (a)	5	English Composition (a)	5
Arithmetic (a)	5	Algebra (b)	5
Greek History (a)	3	Roman History (a)	3
Drawing (a)	1	Drawing (a)	1
Wood Joinery (Men) (a)	2	Wood Turning (Men) (b)	2
Sewing (Women) (a)	2	Sewing (Women) (a)	2
Military Drill (Men)	1	Military Drill (Men)	1
Physical Culture (Women)	1	Physical Culture (Women)	1

SECOND YEAR

Rhetoric (b)	4	Rhetoric (b)	4
Algebra (b)	4	Algebra (b)	4
Mediaeval History (b)	3	Modern History (b)	3
Biology (a)	3	Biology (a)	3
Military Drill (Men)	1	Military Drill (Men)	1
Physical Culture (Women)	1	Physical Culture (Women)	1
Elect one of the following:		Elect one of the following:	
German or Latin (a)	4	German or Latin (a)	4
Garment Making (Women) (b)	4	Cooking (Women((a)	4
Mechanical Drawing (Men) (f)	2	Mechanical Drawing (Men) (f)	2
Forging (Men) (c)	2	Forging (Men) (c)	2

THIRD YEAR.

English Literature (c)	4	English Literature (c)	4
Plane Geometry (c)	5	Solid Geometry (c)	5
Physics (a)	3	Physics (a)	3
Drawing (b)	2	Drawing (b)	2
Military Drill (Men)	1	Military Drill (Men)	1
Physical Culture (Women)	1	Physical Culture (Women)	1
Elect one of the following:		Elect one of the following:	
German or Latin (b)	4	German or Latin (b)	4
Bills of Fre and Cooking Demonstrations (Women) (d)	4	Dressmaking (Women) (c)	4
Mechanical Drawing (Men) (g)	2	Mechanical Drawing (Men) (g)	2
Cabinet Making or Metal Working (Men) (d) or (e)	2	Cabinet Making or Metal Working (Men) (d) or (e)	2

Description of Preparatory Courses

ENGLISH.

(a) **English Composition.**—The aim of the course is to secure accurate and graceful expression, and to afford constant exercise in composition. In connection with this work English classics will be made the subject of class room study forming a basis for the study of literature. I and II. 10.

(b) **Rhetoric.**—This is a continuance of course (a). One hour a week is given in elocution. Each student is required to write at least one paper per week based on textbook work. I and II, 8.

(c) **Literature.**—The object of this course is to develope an intelligent appreciation of American and English masterpieces and to promote a taste for the best literature. A series of classics similar in number and kind to the New England College requirements are made the material for critical class room study. The student will find in the library valuable works for reference. I, II, 8.

HISTORY.

(a) **Greek and Roman Mistory.**—The aim is to give a general survey of the history of these two most important nations of the ancient world. The textbook is supplemented by library work. I, II, 6.

(b) **Mediaeval and Modern History.**—A study of the most important epochs of the middle ages and modern times. The library is well supplied with valuable reference works. I and II, 6.

LATIN.

(a) **Beginning Latin.**—In the first year's work the aim is to secure a ready knowledge of the inflectional forms, the main rules of syntax, and a vocabulary which will prepare for easy Latin reading. For this purpose Collar and Daniell's Latin Book is used, which in connection with grammatical study gives reading lessons adapted to the ability of the learner. I and II, 8.

(b) **Latin Readings.**—Drill similar to that of the first year is continued in this course in connection with the reading of easy selections from classic authors such as are found in Rolfe and Dennison's Junior Latin Book. The aim is to enable the student to read the simpler classics readily. I and II, 8.

GERMAN.

(a) **Beginning German.**—The work of the first year is of the usual elementary nature, including study of grammar, composition, pronunciation, careful reading of easy texts and sight reading. I and II, 8.

(b) **German Readings.**—The second year's work is also largely practical but affords as well an introduction to classic German literature. The required reading during the two years is not less than 600 pages. I and II, 8.

MATHEMATICS.

(a) **Arithmetic.**—A review of arithmetic the first semester of the first year. Emphasis is placed upon the topics important in later study of mathematics. I. 5.

(b) **Algebra.**—Three semesters are given to algebra. I, II, I, 13.

(c) **Geometry.**—One year is devoted to plane and solid geometry. I, II. 10.

SCIENCE.

(a) **Elementary Physics.**—Lectures with experimental illustrations, recitations, assigned problems and laboratory work three hours per week throughout the year in mechanics, sound, heat, light, electricity and magnetism. Textbooks; High School Physics, by Carhart and Chute, and Laboratory Notes, by Cobleigh. I and II, 6.

(b) **Biology.**—This course will be conducted in such manner as to give the pupils a good understanding of the first principles of the science of living things. While the subject of the course will be taken from the field of zoology and botany, it is not the purpose to train zoologists and botanists, but to equip the pupils, by the information and training given, to observe and interpret simple biological facts. Recitations and laboratory exercises. I and II, 6.

DRAWING.

(a) **Drawing.**—Freehand drawing from geometric solids and casts. Study of light and shade. Clay modeling. Object drawing. Study of plant forms, with suggestions for their application to design. Memory and time drawing. Blackboard work frequently. I and II, 2.

(b) **Drawing.**—Continuation of course (a) with increase of work in water color, wood carving, oil painting, etc. I and II, 4 .

MANUAL TRAINING.

(a) **Wood Joinery.**—This work will consist of bench work in wood with instruction in the use of the ordinary carpenter's tools and practice in working from blue prints. I, 2.

(b) **Wood Turning.**—This comprises work on the lathe in turning useful and ornamental objects such as chisel handles, table legs, vases, rings, etc. II, 2.

(c) **Forging.**—This work will include forging and welding of iron and

the making and tempering of some steel tools such as chisels and punches. I, II, 4.

(d) **Cabinet Making.**—This will comprise the making of tables, desks, bookcases and other furniture. I and II, 4.

(e) **Metal Working.**—The courses in metal working will consist of advanced forging and bench work in metals, hand fitting and finishing with simple machine work. The student will choose between cabinet making and metal working. I and II, 4.

(f) **Mechanical Drawing.**—The student is first given work in freehand and mechanical lettering. The remainder of the year is given up to freehand sketching of objects with a few plates of mechanical drawings made from the sketches. The second year's work will include detail, drawing, cabinet and isometric projections, shading, water colors and tracing. I and II, 8.

DOMESTIC SCIENCE.

(a) **Sewing.**—This subject is required of all girls during both semesters of the first year. The work is chiefly plain sewing, with some practice in garment making. Each student furnishes her own materials, as the garments made form a part of her own wardrobe. Students passing a satisfactory examination in sewing will be excused. I, II, 4.

(b) **Garment Making.**—In this course at least five garments and two shirt waists must be completed. I, 4.

(c) **Dressmaking.**—The McDowell system of dresscutting is taught. In this course and the preceding, the girls furnish their own materials and the completed work is their own. Many girls are enabled by taking this course to do all their own sewing. II, 4.

(d) **Cooking.**—This work may be elected in the second semester of the second year and the first semester of the third year. The course will include both lectures and practice. I and II, 8.

School of Agriculture.

A great majority of the young men in the rural communities finish their education in the common schools. They have had little or no opportunity to become acquainted with the science underlying farm work. The young men who expect to become farmers are cordially invited to enter the course in the school of agriculture. The aim is to educate the student toward the farm, and to develop a love for farm life by showing the possibilities of scientific agriculture.

The course extends through three years of six months each and comes in the winter season when the young people can be spared from farm work. For entrance to this course, a student must have finished the 8th grade of the common schools or its equivalent. Those who satisfactorily complete this course will be given diplomas. The general fee of $6.00 is charged; laboratory fee of $2.00 is required in dairying, chemistry and soil physics. The shop deposit is $2.00 per year.

FIRST YEAR.

English Composition (Eng. d)	3	English Composition (Eng. d)	3
Elementary Physics (Physics b)	3	Physics (Phys. b)	3
Carpentry (M. E. g)	2	Carpentry (M. E. g)	2
Nursery Practice (Hort. a)	3	Breeds of Livestock (An. Ind. b)	3
Animal Types (An. Ind. a)	3	Crop Production (Agron. a)	4
Poultry (An. Ind. a)	3	Vegetable Gardening (Hort. b)	3
Botany (Biol. b)	4	Civics	3
Drill	1	Drill	1
	22		22

SECOND YEAR

Rhetoric (Eng. e)	2	Rhetoric (Eng. e)	2
Elementary Chem. (Chem. a)	2	Elementary Chem. (Chem. a)	3
Field Crops (Agron. b)	4	Plant Diseases (Biol. C)	4
Orcharding (Hort. c)	4	Forestry (Hort. d)	4
Farm Dairying (Dairy a)	3	Cheese Making (Dairy b)	3
Forge Work (M. E. h)	3	Forge Work (M. E. h)	3
Mechanical Drawing (M. E. f)	2	Soil Physics (Agron. c)	4
Drill	1	Drill	1
	22		22

THIRD YEAR.

Literature (Eng. f)	2	Literature (Eng. f)	2
Economic Entomology (Biol. d)	4	Economic Entomology (Biol. d)	4
Principles of Breeding (An. Ind. d)	4	Live Stock Feeding (n. Ind. c)	4
Agr. Mechanics (C. E. f)	2	Agri. Mechanics (C. E. f)	2
Veterinary Science (An. Ind. f)	3	Veterinary Science (An. Ind. f)	4
Soil Fertility (Agron. d)	3	Farm Management (Agron. e)	3
Landscape Gardening (Hort. e)	3	Elective	2
Drill	1	Drill	1
	22		22

INTERMEDIATE COURSE.

The students who finish the school of agriculture course and desire to go on to the college courses, will find themselves deficient in some subjects needed as preparation for this advanced work.

For those students the following intermediate course is offered. Upon the completion of this one year course the students may enter any of the college courses as freshmen.

Algebra	5	Algebra	5
Plane Geometry	5	Solid Geometry	5
German or French	4	German or French	4
History	5	History	5
	19		19

Equipment

Students in this course have the advantage of a modern dairy in daily operation, a complete plant with several breeds of the best poultry, model farm buildings and barns with pure bred live stock, the experiment station farm, green houses and orchards, the large biological, chemical and physical laboratories, and the well equipped wood and iron shops of the engineering departments. The methods employed are practical. The instruction is supplemented with practice in the laboratories, the dairy, the orchards, the greenhouse, and with the herds. Visits are also made to other farms and herds in the neighborhood.

AGRONOMY.

(a) **Crop Production.**—This course includes a study of the principles underlying, and the factors influencing reproduction, germination and growth in agricultural plants. II, 4.

(g) **Field Crops.**—A study of the various classes of farm crops, their history, cost of production, consumption, products and by-products. In this course, some time is devoted to the judging of grains. I, 4.

(c) **Soil Physics.**—A review of the origin, formation and classification of soils, and a careful study of the conditions, influencing the supply of heat and air and moisture as related to growing plants. II, 4.

(d) **Soil Fertility.**—Maintenance of fertility, fertilizers and rotation. The influence of manure and the effect of the different crops upon the productive capacity of the soil and upon succeeding crops. I. 3.

(e) **Farm Management.**—This course considers the business side of farming as an industry, also the relation of farming to the other industries. II, 3.

ANIMAL INDUSTRY.

(a) **Animal Types.**—Or a study of types as related to production and work. Three types of cattle, the dairy, beef, and dual purpose; the market classes of horses, the bacon and lard types of hogs and the mutton and wool types of sheep. I, 3.

(b) **Breeds of Live Stock.**—This is a study of the different breeds of live stock, of the forces which have produced them, and of their adaptability to various conditions and management. II, 4.

(d) **Principles of Breeding.**—This course includes a study of the laws of heredity, correlation, reversion, variation, fecundity, methods of breeding, crossbreeding, selection, etc. I, 4.

(e) **Poultry.**—Type and management. Feeding and care of poultry. I, 3.

(f) **Veterinary Science.**—The work in veterinary science consists principally of the study of the different diseases most commonly affecting farm stock, with special reference to diagnosis and treatment. I, 3.

DAIRYING.

(a) **Farm Dairying.**—The study of dairying as related to the farm; the care of the cows; the production of sanitary milk, and the handling of the milk for the creamery or city delivery; the construction of milk houses and stables; the advantages of the hand Babcock tester on the farm and the making of the test; a comparison of the gravity and hand separator methods; how to set up and care for the separator so as to get the best results; an opportunity is afforded to study and compare all the leading makes of hand separators. Butter making takes up the practical methods to employ on the farm for the ripening of the cream, the churning, packing and marketing of butter. I, 3.

(b) **Cheese Making.**—The making of cheddar cheese on the farm. This will comprise a study of the care of the milk for cheese making; the process of manufacture, and the curing and marketing. A short course is given also in creamery accounts with particular reference to the paying for milk or cream at the creamery and the general handling of the business end of the creamery, to fit young men for co-operative creamery managers and secretaries. II, 3.

HORTICULTURE.

(a) **Nursery Practice.**—This subject deals with the propagation of fruit and ornamental plants for both home and commercial purposes. The work is given in lectures, textbook, and practice in the laboratory and greenhouse. I, 3.

(b) **Vegetable Gardening.**—The methods of growing vegetables in the field and under glass, hot bed construction and management, and the

marketing and gathering of vegetables are treated in lectures, textbooks and practice in the field and greenhouses. II, 3.

(c) **Orcharding.**—The growing, harvesting, and marketing of tree and small fruits are studied. Special attention is given to the methods of culture and varieties adapted to Montana conditions. The experiment station orchard offers good opportunities for student work in fruit growing. I, 4.

(d) **Forestry.**—The planting and growing of wind breaks upon farms, the effect of forests upon farm lands, methods of conservative lumbering and preservation of forests, the effect of forests upon water supply, rainfall, temperature, etc., are features of this course. II, 4.

(e) **Landscape Gardening.**—In this course, particular attention will be given to the study of plans for laying out and planting farm homes. The trees, shrubs, and flowering plants suitable for Montana conditions will be studied with methods of propagating and growing them. I, 3.

BIOLOGY.

(b) **Botany.**—Two recitations and two laboratory periods per week. The elements of botany are taken up, especially with a view to the needs of agricultural students. The classification, physiology and ecology of plants are briefly covered. I, 4.

(c) **Plant Diseases.**—Two recitations and two laboratory periods per week. So far as possible in the limited time available the diseases of the various agricultural and horticultural plants will be studied. This work will be conducted upon a scientific basis but at all times the needs of the practical agriculturist will be kept in view. II, 4.

(d) **Entomology.**—Two recitations and two laboratory periods per week. After a very brief survey of the animal kingdom the anatomy, physiology, habits, transformations, and classification of insects are studied, together with the methods of controlling injurious species. This course is designed, in a comprehensive manner, to prepare the student for defense against the various insect pests of the farm, orchard and garden. I, II, 4.

CHEMISTRY AND PHYSICS.

(a) **Elementary Chemistry.**—Lectures with experimental demonstration three times per week on the principal elements and the essential laws of chemistry including their relation to air, water, and soil, and to plant and animal life. Special attention is also paid to such processes as the preparation of formalin, oleomargarine, soap, vinegar, paper, etc., as these have immediate bearing upon the daily life of the farm. I, II, 6.

(b) **Elementary Physics.**—Physics lectures, recitations and assigned problems three hours per week on topics selected from mechanics, heat,

light, electricity, and magnetism. Emphasis will be placed upon these subjects which either have a direct application to agricultural problems or which are desirable as a preparation for some subsequent study in the course. The lectures will be illustrated with numerous experiments and lantern slides. It will be from properly interpreting the class room exercises and from the working of many practical problems that the student will derive the most benefit. Millikan and Gale's First Course in Physics will be used as a textbook. I, II, 6.

ENGLISH.

(d) **English Composition.**—The first year is devoted largely to practice in the simpler forms of composition. Attention is given to business forms, letter writing, narration, and to the formation of habits of correct speech. I, II, 6.

(e) **Rhetoric.**—During the second year more advanced work is given in composition with frequent essays, reviews, etc. A few masterpieces are studied as a basis for style of expression. I, II, 4.

(f) **Literature.**—The third year gives a comprehensive study of English and American literature. The object is to develop an appreciation for the works of the standard authors and a taste for the great masterpieces of the language. I, II, 4.

AGRICULTURAL MECHANICS.

(f) **Farm Mechanics.**—A study of the construction and operation of the various machines used on the farm. Gasoline engines, pumps, binders, mowers, cleaners, and other farm machines will be taken apart and assembled by the students. Special attention will be given to pumping machinery—pumps, windmills, steam, gas and gasoline engines and their application to irrigation. Considerable attention will be given to the cost of operation and conditions governing the life and efficiency of pumping machinery.

OTHER SUBJECTS.

For carpentry, forge work, and mechanical drawing, see description of courses in steam engineering and machine shop.

School of Pharmacy.

V. K. CHESNUT, Prof. of Chemistry.

..... Asst. Prof. of Pharmacy.

DEAN B. SWINGLE, Asst. Prof. of Botany.

FRANK W. HAM, Instructor in Chemistry.

Aim.—The object of this school is to provide the people of the state with pharmacists who are not only competent to fill out prescriptions and dispense drugs, but who can also test and fully vouch for the strength and purity of the drugs which they sell.

Course.—The course in pharmacy requires two years, each of thirty-six weeks, for completion and also qualifies the graduate to meet the examinations given in any state for the position of registered or licensed pharmacist.

Admission.—For admission to this course the student must not be less than 17 years of age and must present a diploma from an accredited high school or pass an examination on an equivalent amount of work.

Expenses.—In addition to the annual tuition fee of $12.00, deposits of $8 for chemistry, $5 for pharmacy and pharmacognosy and $5.50 for botany are required in the junior year, and deposits of $10 for chemistry and $10 for pharmacy and materia medica in the senior year.

Degree.—The degree of Graduate of Pharmacy (Ph. G.) is conferred on all who have satisfactorily completed the course in pharmacy.

Equipment.—Students in pharmacy have access to such of the chemical and botanical laboratories as their work calls for, and to the special laboratories of pharmacy and materia medica.

SCHOOL OF PHARMACY.

JUNIOR YEAR.

General Inorg. Chem. (Chem. 1 & 2)	4	General Inorg. Chem. (Chem. 1 & 2)	4
Pharmacy (Pharm. 1)	5	General Botany (Biol. 9)	5
Latin (Latin a)	4	Blowpipe Analysis (Chem. 19)	1
Elective	2	Pharmacognosy (Pharm. 2)	5
	15		15

SENIOR YEAR.

Organic Chem. (Chem. 10)	3	Organic Chem. (Chem. 10)	3
Inorg. Materia Medica (Pharm. 3)	2	Organic Materia Medica (Pharm. 4)	5
Pharmacy (Pharm. 5)	7	Prescriptions (Pharm. 6)	2
Pharmaceutical Econ. (Pharm. 9)	1	Drug Assaying & Test. (Pharm. 7)	4
Mont. Pharm. Law (Pharm. 10)	1	Therapeutics (Pharm. 8)	3
Emergency Aid (Pharm. 11)	1		
	15		17

1. **Pharmacy.**—A study of the theory and practice in the use of chemical and pharmaceutical apparatus. The manipulation of apparatus which is given in chemistry (1) is supplemented by a study of weights and measures, specific gravity, specific volume, percentage solutions, vaporization, solution, crystalization, distillation, comminution dialysis, extraction and percolation. The attention of the student is practically directed to the various classes of pharmacopoeial preparations and the liquid preparations are taken up in great detail. I, 5.

2. **Pharmacognosy.**—The use of the hand lens and compound microscope in the study of the roots, stems, leaves and seeds of drug plants. The student is made familiar with the special characteristics of the important drugs through the preparation of slides and sketches showing their more salient points of difference. II, 5.

3. **Inorganic Materia Medica.**—A study of the occurrence, preparation, properties and history of the official drugs of inorganic origin with special consideration of their identification, purification, physiological action, and antidotes. I, 2 .

4. **Organic Materia Medica.**—A study of the occurrence, properties, and history of the official and some other much used drugs of plant and animal origin with special reference to their identification, physiological action and antidotes. Due attention is paid to the habitat, the active constituents and their extraction and to the detection of the common adulterants of drug plants. II, 5.

5. **Pharmacy.**—This is largely a laboratory course which affords opportunity for the practical application of the theoretical knowledge in chemistry and pharmacy which the student has acquired during the junior year. All of the active constituents of plant drugs, such as acids, alkaloids, volatile and fixed oils, glucosides, balsams, and bitter principles are considered from the pharmaceutical standpoint and one or more preparations are made of each of the several classes represented in the U. S. Pharmacopoeia. These preparations are made in conformity with the pharmacopoeial requirements and must respond to all of the official tests. The effect of simple oxidization and the action upon drugs of bacteria and enzymes are also considered, together with the methods for the best preservation of drugs. Due consideration is also paid to some of the more important unofficial preparations. I, 7.

6. **Prescriptions.**—Lectures, recitations and laboratory work in the art of compounding and dispensing drugs. Special attention is paid to incompatibility and the filling out of prescriptions. II, 2.

7. **Drug Assaying and Testing.**—Practice according to pharmacopoeial methods in the assaying of some official and other important drugs, together with exercises in testing drugs, both chemically and pharmacologically. II, 2.

8. **Therapeutics.**—All of the different classes of drugs are considered

with reference to their sensible properties and physiological action. II, 3.

9. **Pharmaceutical Economics.**—The consideration of store equipment and arrangement, buying, selling, patents, trade interests, relation to the physician, side lines, profitable and unprofitable manufacturing, advertising, etc. I, 1.

10. **Montana Pharmacy Law.**—A consideration of the rights and privileges of pharmacists under the pharmacy laws and regulations of the State of Montana. I. 1.

11. **Emergency Aid.**—A series of lectures designed to qualify the pharmacists to administer first aid to the injured or poisoned. I, .1

Course in Steam Engineering and Machine Shop.

This course is offered for those who desire to fit themselves for operating heating and power plants, or to enter a wood, forge or machine shop. It occupies two years of about six months each. For a description of the steam engine, boilers, and shop equipment available for use in this course, see the write-up under mechanical engineering in this catalog.

A student to carry this course should be familiar with arithmetic and able to handle algebra and geometry. The work in mathematics is intended to keep the student far enough advanced in that subject to solve the problems in connection with the work in steam engineering. A certificate will be granted to those who satisfactorily complete this course.

The general fee is $6.00 a year. The deposit for shop work is $4.00 a year.

The figure opposite the subject in the course below indicates the number of hours per week the subject occupies.

FIRST YEAR.

Arithmetic	4	Algebra	4
Steam Engineerng	5	Steam Engineering	5
Engine Practice	6	Engineering Practice	6
Mechanical Drawing	6	Mechanical Drawing	6
Wood Work	6	Forge Work	6
	27		27

SECOND YEAR

Algebra	4	Geometry	4
Steam Engineering	3	Steam Engineering	2
Boiler Room	4	Boiler Room	4
Plant Operation	2	Mechanical Drawing	6
Mechanical Drawing	6	Machine Work	9
Forge Work	9		
	28		25

Mathematics.—One term is given to arithmetic, two to algebra and one to geometry. Only those topics are studied which are used in solving the problems arising in connection with the steam engine and shop work.

Steam Engineering.—Boilers, their construction, setting, fittings and attachments, with pumps, injectors, feed water heaters, condensers, steam piping, stokers and chimneys are studied in conjunction with combustion of fuel, treatment of feed water, physical properties of steam, and evaporative capacity of boilers. Steam engines, their construction and horse power; valves, valve gears, valve setting, indicator card analysis; and brakes, belts and pulleys are taken up in detail.

The class room work in steam engineering is a careful study and discussion of boiler and engine room practice from the standpoint of safety and economy.

Engine Practice and Boiler Room.—In addition to class room work a large amount of time is given to practice and inspection work with steam apparatus, of which the department has ample variety for illustrative purposes. The work includes also the firing and care of boilers, operation of traction and stationary engines, with tests, and care and operation of dynamo and switch board.

Shop Work.—The shop work consists of sufficient practice with carpenter's tools, with blue prints, to develop care and accuracy, and an understanding of mechanical drawing, followed by a thorough course in forge work in iron and steel, and a term in the machine shop, chipping and filing, laying out work, fitting, with work on drill press, shaper, planer, and engine lathe.

Mechanical Drawing.—The mechanical drawing of this course is made to apply especially to the class of work that the steam engineer and shop man have most use for. After the student has learned the use of the instruments he is given the task of making working drawings of actual objects and when the course is finished he should be able to understand and make any drawing of this character.

Plant Operation.—Lectures are given in the matter of plant operation in which are explained the care and operation of dynamos and motors, the purpose and use of the ordinary instruments on a switch board, the troubles met with in small plants of this kind and the remedies for them. The work is illustrated as far as possible by means of the electrical equipment of the power plant and laboratory.

Requirements for Admission—The student shall be at least eighteen years of age. He shall pass an examination in arithmetic and English corresponding to eighth grade work in a graded school or present a certificate showing a satisfactory completion of one or more years in an accredited high school.

Water Commissioner's Course.

PROF. TANNATT.

MR. ANDERSON

Leveling (a)	7	Leveling (a)	7
Water Measurements (b)	3	Water Measurements (b)	3
Drainage & Irrigation (c)	7	Drainage and Irrigaton (c)	7
Road Construction (d)	1	Road Construction (d)	1
Irrigation Law (e)	1	Irrigation Law (e)	1
Elective	6	Elective	6

(a) **Leveling**—The care, use, and adjustment of the level; keeping of field notes, and plotting; laying out grades; constructing profiles and cross-sections. One hour recitation, six hours field work and plotting per week.

(b) **Water Measurements.**—This study will deal largely with hydraulics, taking up the theory of the flow of water in canals, flumes, pipes and ditches; the deriving of formulae used in hydraulic calculations: theory of the current meter, weir, and other hydraulic measuring instruments, with methods of using the same. Three hours per week.

(c) **Drainage and Irrigation.**—Methods of laying out drains and canals; construction and placing of headgates, weirs, flumes and divisors; construction and use of hydraulic diagrams and tables; seepage and evaporation losses in canals and ditches. The practical use of the current meter, weir, and other measuring instruments. Three hours recitation and four hours field work and drawing per week.

(d) **Road Construction.**—This course will consist of a series of lectures designed to familiarize the student with the principles of laying out, constructing and maintaining county wagon roads. The course is designed to enable the student to intelligently fill the position of road supervisor; it is not intended, however, to investigate the subject as thoroughly as is contemplated in "Highway Construction" of the Civil Engineering course Practical work will be given in road construction. This course of lectures would be of value and assistance to the road supervisors of the state.

(e) **Irrigation Law.**—A course of lectures upon the duties of the water commissioner, and the irrigation laws of Montana.

Elective.—To be selected, without conflict, from the short course in steam engineering.

Course in Household Economy

The one year course is intended for those who wish systematic work in household economy and who cannot take the time for a four year course. The work is necessarily much more elementary than in the longer course and no degree is given. A diploma, crediting the student with one year's work, is given upon the satisfactory completion of the course.

In addition to cooking, sewing, household economy and sanitation, art is required and either music or English may be elected. Those who make a grade of A or B in art the first semester may elect dairying the second semester.

Cooking (g)	10	Cooking (g)	6
Household Economy (e)	5	Sanitation (f)	5
Sewing (h)	8	Sewing (h)	12
Art (c)	3	Art (c)	3
Music or English	4	Music or English	4

(6) Household Economy.—House construction and material furnishings, management, and care of all parts of the house. The textbook used is Miss Parloa's Home Economics. Lectures on marketing are also given, including such subjects as methods of buying, home and foreign products, care of supplies, household arts, as cleaning, sweeping, cleaning paint, windows and metals, care of dining room, duties of hostess and waitress, table etiquette, planning bills of fare, and calculation of cost of various dishes made in the cooking class. Five papers must be handed in during the semester on some subject pertaining to home economics. 5 lectures each week. 1, 5.

(f) Sanitation.—The house site, surroundings, cellar, ventilation, lighting, heating, plumbing, drainage, water supply, disposal of refuse, general care of the house. Five papers must be handed in during the semester. 5 lecture periods per week. II, 5.

(g) Cooking.—This work is both thoretical and practical. During the second semester each student gives one demonstration. Much attention is given to serving meals. For final examination each student prepares two three-course luncheons. Six hours each week for the year; four practice periods and two demonstration. I, 10; II, 6.

(h) Sewing.—During the first semester six garments must be completed. During the second semester four shirt waists, a coat suit, or lined dress, and the graduating dress must be completed. The Darling system of cutting and fitting is taught. I, 8; II, 12.

(c) Dairying.—The elaboration, composition, properties, and fermentations of milk. The methods used in testing, buying, and preserving milk for food, or for manufacturing purposes. The manufacturing of butter and cheese, with explanations of the defects in much of the butter and cheese used for domestic purposes, and how these defects may be de-

tected and overcome. Students who desire may take practical work in the college dairy along with the special dairy students, in both butter and cheese making.

(c) Art.—Freehand drawing from geometric solids and casts. Study of light and shade. Clay modeling. Object drawing. Study of plant forms, with suggestions for their application to design. Memory and time drawing. Blackboard work frequently.

Short Courses in Agriculture

Beginning January 6th, 1908 the agricultural college will offer a series of short courses in agriculture, horticulture, live-stock and dairying. These courses are designed to meet the needs of those farmers, both young and old, who cannot leave home for any length of time and yet desire to get in touch with and learn more about the principles and the best practice of their business. There is not a farmer in the state but would enjoy and profit by this short time spent at the agricultural college and experiment station getting acquainted with the men, and the work being done for the farmers of the state.

There are no entrance requirements for admission to these courses further than a guarantee of faithful work while here. There will be a tuition fee of $2.00 to cover all courses and the only other cost will be for living expenses and small laboratory fees.

Instruction in the winter course is given by lectures, by practical work, and by excursions. The professors who teach in the regular college course give the lectures and direct the demonstration work in this course and all the equipment of the college is at the service of the students.

For the convenience of those attending, the winter session is divded, according to the purpose, into two successive courses. The first, lasting two weeks, Jan. 6-18, has to do with the general phases of farm work, including both field work and animal industry. The second course, taking one week, Jan. 20-25, has to do with farm dairy work and takes up the study of animal industry, also, as related to this special line.

WINTER COURSES.

General Agricultural Course—two weeks—Jan. 6th to 18th.

Agronomy	18 lectures
Horticulture	18 lectures
Animal Industry	18 lectures

Farm Dairy Course—one week—January 20th to 25th.

Animal Industry	15 lectures
Dairying	15 lectures

For those who wish to prepare for regular creamery work, the following course is offered:

FOUR WEEKS' CREAMERY COURSE.

Beginning just after the series of short courses for farmers there will be a four weeks creamery course, running January 27 to February 21. As there is a growing demand for butter and cheese makers in the state, this course has been designed to especially fit young men to fill these positions. The course will last four weeks, and all of the student's time will be spent in the college creamery and in doing the actual work on the dairy floor. By this means he will be brought into touch with the problems of the average factory. In addition to the creamery practice, two lectures will be given each day dealing with subjects that it will be impossible to take up in the practice on account of the short time allowed for this work. On the last day a final examination will be held. By this means as well as by the students' work in the creamery, it will be possible to judge of their ability to fill available positions.

Names of Students

GRADUATING CLASS, JUNE, 1906.

Benton, Ralph	Zoology	Washington, D. C.
Bole, William Symington	Zoology	Great Falls.
Chaffee, Catherine Sarah	Zoology	Bozeman.
Flager, Howard A.	Electrical Eng.	Red Lodge.
Kirk, Mary	History	Bozeman.
Penwell, Clyde C.	Mathematics	Belgrade.
Potter, Ermine L.	History	Bozeman.

POSTGRADUATES.

Chaffee, Catherine Sarah, B. S.	Mathematics	Bozeman.
Ham, Frank W., M. S.	Chemistry	Bozeman.
Keeler, Mrs. Ida, A. B.	Mathematics	Bozeman.
Quaw, Lucile, B. S.	Domestic Science	Bozeman.

—4.

SENIORS

Baker, Harold E.	Elect. Eng.	Bozeman.
Breneman, Anna T.	Math.-Physics	Bozeman.
Bull, Frieda Mildred	Math.-Physics	Bozeman.
DeMuth, Maud S.	Math.-Physics	Peru, Indiana.
Flager, Harold J.	Elect. Eng.	Red Lodge.
Griffith, Warren J.	Elect. Eng.	Gebo.
Hartman, Lois.	Domestic Science	Bozeman.
Lorentz, Floyd S.	Elect. Eng.	Toston.
Mountjoy, Agnes	Math.-Physics	Twin Bridges.
Osborn, Belle	Domestic Science	Bozeman.
Pease, Levi J.	Civil Eng.	Bozeman.
Penwell, Clyde C.	Elect. Eng.	Belgrade.
Penwell, Clyde W.	Elect. Eng.	Utica.
Quaw, Thomas B.	Biology	Bozeman.
Thorpe, Elizabeth	History-Literature	Bozeman.
Thorpe, Mabel A.	Math.-Physics	Bozeman.

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JUNIORS

Alward, Mamie	Chemistry	Bozeman.
Bromley, Arthur	Math.-Physics	Bozeman.
Butter, Donald	Elect. Eng.	Culbertson.
Cooke, Amy M.	Math.-Physics	Bozeman.
Driscoll, William J.	Civil Eng.	Lawrence, Mass.
Fisher, Charles M.	Elect. Eng	Bozeman.
Gottschalck, Carl	Chemistry	Bozeman.
Hartman, Will	Civil Eng.	Bozeman.
King, Ruby Ellen	Domestic Science	Bozeman.
Leonardy, Waldo	Elect. Eng.	Deer Lodge.
Morgan, Phoebe	Domestic Science	Bozeman.
Mountjoy, Irvine	Elect. Eng.	Twin Bridges.

Peterson, James Arthur	History-Literature	Absarokee.
Robinson, J. Wilbur	Chemistry	Bozeman.
Rounds, John E	Elect. Eng	Deer Lodge.
Tracy, Edna	Chemistry	Bozeman.
Widener, Carl C.	Civil Eng.	Bozeman.

—17.

SOPHOMORES

Bancroft, Roy E.	Agriculture	Oakley, Kans.
Bull, Mary Edna	Domestic Science	Bozeman.
Coppedge, Roy J.	Elect. Eng.	Fish Tail.
Edwards, Timothy F.	Civil Eng.	Frazee, Minn.
Hanson, Gilbert E.	Elect. Eng.	Bozeman.
Henderson, C. Lisle	Elect. Eng.	Livingston.
Hind, Bert S.	Elect. Eng.	Kendall.
Homan, Fred C.	Mechanical Eng	Bozeman.
James, John Sexton	Civil Eng.	Cascade.
Kimpton, Addie Pearl	Domestic Science	Radersburg.
Kirscher, William Guy	Elect. Eng.	Townsend.
King, Charles E.	Elect. Eng.	Fort Benton.
Kremer, William J.	Civil Eng.	Mt. Carroll, Ill.
Livingston, Walter T.	Civil Eng.	Bozeman.
Milner, Thomas A.	Civil Eng.	Milner.
Morrison, Bertha	Hist.-Literature	Bozeman.
Morris, Elwod	Agriculture	Virgina City.
Mountjoy, John	Agriculture	Twin Bridges.
Noble, Erma	Domestic Science	Bozeman.
Peters, Orville S.	Elect. Eng	Junction, Wis.
Robinson, James Frederick	Agriculture	Bozeman.
Smith, Harry D.	Civil Eng.	Amboy, Ind.
Spain, W. Whitfield	Agriculture	Bozeman.
Vreeland, Edna	Domestic Science	Bozeman.
Wilson, Elva A.	Hist.-Literature	Bozeman.

—25.

FRESHMEN

Accola, Louise	Domestic Science	Bozeman.
Allard, Louis	Agriculture	Laurel.
Allen, Edgar	Chemistry	Red Lodge.
Anderson, Lee B.	Elect. Eng.	Bozeman.
Barnard, Robert B.	Elect. Eng.	Great Falls.
Bechtel, Leslie E.	History-Literature	Butte.
Bell, James C.	Agriculture	Gilt Edge.
Berg, Benjamin E.	Elect. Eng.	Columbus.
Booker, Clinton T.	Elect. Eng.	Helena.
Brewer, Lucile	Domestic Science	Gordon, Neb.
Brown, Archie S.	Elect. Eng.	Great Falls.
Davidson, Mary Ellen	Domestic Science	Bozeman.
DeMuth, David R.	Civil Eng.	Peru, Ind.
Duncan, Zoe Bertha	Domestic Science	Bozeman.
Dunekel, Emma	Domestic Science	Butte.
Ellis, Wilder P.	Elect. Eng.	Helena.
Fisher, Helen	Domestic Science	Bozeman.

Fox, Hazel	Math.-Physics	Bozeman.
Flager, Ruth	Domestic Science	Red Lodge.
Froebe, Frank	Civil Eng.	Absarokee.
Fuller, Ruth G.	Domestic Science	Bozeman.
Giles, George M.	Civil Eng.	Bozeman.
Gillett, Howard L.	Agriculture	Bozeman.
Griffith, Leslie	Chemistry	Pawnee, Neb.
Gray, Wright	Agriculture	Bozeman.
Hartman, June	Math.-Physics	Bozeman.
Henderson, Charles F.	Elect. Eng.	Hall.
Higgins, Harold P.	Civil Eng.	Townsend.
Higgins, Jewell	Civil Eng.	Townsend.
Hodson, Rodney	Civil Eng.	Lat.
Hogan, George R.	Agriculture	Musselshell.
Jackson, Faith	Domestic Science	Ferguson.
Jones, Rose	Domestic Science	La Platte, Mo.
Keeler, Otis E.	Elect. Eng.	Bozeman.
Keene, Franklin U.	Civil Eng.	Townsend.
Keene, Newton	Mechanical Eng.	Townsend.
Kennedy, Cyril C.	Elect. Eng.	Glendive.
King, Willard	Biology	Livingston.
Kittams, Samuel A.	Civil Eng.	Straw.
Lewis, Max A.	History-Literature	Dewey.
Livingston, Mildred	Domestic Science	Bozeman.
Luther, J. Glenn	Elect. Eng.	Choteau.
Luther, Edith	Chemistry	Choteau.
Marshall, Bertha A.	Domestic Science	Everett, Wash.
McCullough, Grace K.	Domestic Science	Gebo.
Mountjoy, Lucile	Hist.-Literature	Twin Bridges.
Nevaro, Isabel	Domestic Science	Toronto, Can.
*Olson, Oscar W.	Elect. Eng.	East Helena.
Pool, Louis K.	Civil Eng.	Townsend.
Quaw, Eugene C.	Hist.-Literature	Bozeman.
Sloan, Wm. Glenn	Civil Eng.	Helena.
Soper, Charles H.	Elect. Eng.	Bozeman.
Spain, Marvin	Hist.-Literature	Bozeman.
Stanton, Paul	Elect. Eng.	Bozeman.
Stevenson, Mary	Domestic Science	Radersburg.
Swan, Elizabeth F.	Domestic Science	Bozeman.
Thorpe, Harriet K.	Domestic Science	Bozeman.
Walchli, Fred	Elect. Eng.	Kalispell.
Williss, James E.	Mech. Eng.	Sheridan.
Willson, Herman B.	Elect. Eng.	Bozeman.
Wilson, Harmon	Civil Eng.	Bozeman.
Wylie, Mary Grace	Domestic Science	Bozeman.

* Deceased —62.

IRREGULARS

Andrews, A. L.	Chemistry	Bozeman.
Arnold, Alberta	Domestic Science	Bozeman.
Bird, Frank W.	Civil Eng.	Great Falls.
Kinney, Harriet	Civil Eng.	Bozeman.
Johnson, Thomas O.	Civil Eng.	Plains.

Smith, Clark M. Mech. Eng. Kalispell.
Throm, William Civil Eng. Helena.
Ward, LeRoy Elect. Eng. Bozeman.
Widener, Ethel Hist.-Literature Bozeman.
—9.

ART COURSE

Hayden, Thomas G. Kendall.
Kountz, Mamie Bozeman.
—2.

PREPARATORY SCHOOL.

THIRD YEAR

Boyle, Leslie Fort Benton.
Bessette, William Fulton.
Brown, Willard Glendive.
Clark, Ben Springdale.
Coombs, Ethelbert Laurel.
Cook, George Como.
Cooke, Ruth, ... Bozeman.
Draper, Edward Red Lodge.
Ferguson, Maud Musselshell.
Fitzgerald, Mary Bozeman.
Hammond, Bert Forsythe.
Haines, William Sheridan.
Hutton, Earl Jeffers.
Hutton, Hiram Jeffers.
Krohne, Thornwald Livingston.
Lickel, Harvey Joliet.
Metheney, Blanche Bozeman.
Morrow, Warren Fort Benton.
Smith, Maude Hyde.
Franks, Ethel Bozeman.
Higgins, James Kendall.
Widener, Faye Bozeman.
—22.

SECOND YEAR

Bancroft, Ross Oakley, Kan.
Baker, Lulu Bozeman.
Clark, Olive Hunter's Hot Sp'gs.
Cook, Fred Choteau.
Carter, Eleanor Livingston.
Cummings, Claude Bozeman.
Dusenbury, Fay Bozeman.
Ellis, May Harlem.
Ehrig, Fred Silver Star.
Fly, Earl Laurel.
Foster, Warren Helena.
Green, Jesse Manhattan.
Guest, Elmer Jardine.
Kimpton, Mittie Radersburg.
Landon, Clifford Manhattan.
Lewis, Arlene Dewey.
Lewis, Glenn Dewey.
McGraw, J. L. Springfield, Mo.
Ostrom, Edna Helena.
Penwell, Jean Belgrade.
Perrine, Carlotta Utica.
Schellenberger, Margaret.
..... Willow Creek.
Tannatt, Hazel Bozeman.
Temple, Leslie Radersburg.
Woolsey, Mary McLeod.
Zacher, Frieda Glenullin, N. D.
—26.

FIRST YEAR

Baker, Raymond Bozeman.
Berg, Ida Lennep.
Berg, Oswald Lennep.
Bergman, Roy Drummond.
Cassidy, Frank Winston.
Crail, Eugene Salesville.
Ferguson, Maude Musselshell.
Greene, James Greene.
Kruse, Jacob Belgrade.
Madison, Cora Absarokee.
Madison, Walter Absarokee.
McGuire, Frank Shannon.
Nicholson, Joanna Helena.
Smith, Julia Belgrade.
Spaulding, George Salesville.
Thrailkill, Harry Victor.

Griffith, Gilbert Gebo.
Guiler, William Laurel.
Isaac, Mary Rancher.
Jackson, Ernest Harrison.
Johnson, George Race Track.
Kinney, Martha Bozeman.
Kimberly, George Avon.
Keeler, Howard Bozeman.
Tewey, Dan Race Track.
Uhl, Charles Livingston.
Vaughan, Walter Augusta.
Van Camp, Alfred.....Two Dot.
Van Camp, Ethel.....Two Dot.
Wilkin, Walter.....Livingston.

—30.

IRREGULAR

Hart, Howard H.....Bozeman.
Smith, Alice Garrison.
Williams, E. W.....Bozeman.

—3.

ONE YEAR DOMESTIC SCIENCE.

Alexander, Lulu M.....Bozeman.
Atkinson, Mrs. Alfred....Bozeman.
Baker, Helen F.....Josephine.
Baker, Mary Josephine.
Callantine, Blanche..... Gallop.
Clark, Edith Bozeman.
Gottlob, Annie Howie.
Green, Della S. Manhattan.
Hanley, Fannie.....Bozeman.
Kopp, Lena Bozeman.
LeFevre, Harriet Kalispell.
Martin, Julia Bozeman.
Moore, Nettie Bozeman.
Ostrom, Edna Helena.
Owenhouse, Rosalind Bozeman.
Patterson, Vida Bozeman.
Railey, Sadie Bozeman.
Sandberg, Ellen Chesnut.
Schumaker, Letah Big Elk.
Schumaker, Jewell Big Elk.
Sharon, Hannah Salesville.
Slayton, Lydia Lavina.
Smith, May Kalispell.
Smith, Martha V.....Belgrade.
Van Akin, Roxine.....Bozeman.

—25.

SCHOOL OF AGRICULTURE

Blessing, John Norris.
Callantine, David H.....Gallop.
Calk, James C.....Mt. Sterling, Ky.
Cunningham, Lee Bozeman.
Gilchrist, Fred C.....Great Falls.
Gray, Charles E.....Bozeman.
Hoffman, Albert M.....Bozeman.
Isaac, Walter Rancher.
Jones, William Garniell.
Keene, Guy.....Canton.
Madsen, Hans Butte.
Madsen, Peter.....Denmark.
Malmborg, Edward F.....Chesnut.
Montgomery, Paul P.....Chinook.
Mellgreen, H.....Big Timber.
Mus, Richard.....Missoula.
Phillips, John H. Lewistown.
Poe, Edgar A.....Miles City.
Schumaker, Harry.....Two Dot.
Sheriff, Court, jr.....Canyon Ferry.
Skinner, Edward F.....Lewistown.
Sweeney, Cornelius..... Winston.
Wilcox, Willis D.....Conrad.

—23.

SHORT COURSE IN STEAM ENGINEERING.

FIRST YEAR

Bowhay, Henry J.....Townsend.
Bruce, Clarence L.....Canton.
Buettner, Charles Livingston.
Cain, Edward N.....Helmville.
Chan, Adolp E.....Lewistown.
Chapman, Lester E....Stevensville.
Daniels, C. Edison.....Canton.
Johnson, George B.....Race Track.
LeFevre, Woody E.....Kalispell.
Lockridge, Torrence ..Stevensville.
Maryott, Floyd Salesville.
Papendick, Arthur Kalispell.
Pitts, Everette O....Central Park.
Reich, Walter Butte.

Davis, Cornelius..... Bozeman.
Devlin, William C.....Utica.
Devlin, James H.....Utica.
Forsythe, Orlando..... Busteed.
Gerdts, August Deer Lodge.
Giles, Wallace Shawmut.
Goodfellow, Paul..... ..Ovando.
Gottlob, Peter Howie.
Jansen, Harry J.....Helmville.
Sherman, Claude.... Winston.
Schumaker, Ray Big Elk.
Sleeman, Elmer Stevensville.
Thomas, T. C.....Canton.
Watson, Elmer W.....Watson.
Watson, Robert A.....Watson.
Weber, W. E. Joliet.
Wells, Robert Canton.
—31.

SECOND YEAR

Blewett, Elmer.....Fromberg.
Crawford, Dwight E.....Shawmut.
Haynes, Ernest A.....Clancy.
LeFevre, William T.....Kila.
Leverich, Raymond.....Joliet.
Spain, Rhodes Bozeman.
Timmons, George E.....Havre.
Williams, Wilfred..... Garniell.
—8.

SCHOOL OF MUSIC

PIANO.

Alward, Charles..... Bozeman.
Alward, Coda.....Bozeman.
Bancroft, Alma.....Oakley, Kan.
Brewer, Mrs. W. F.....Bozeman.
Brown, Edith Bozeman.
Callantine, Blanche Gallop.
Carney, Florence Springdale.
Catron, Pearle..... Bozeman.
Cleveland, Grace..... Bozeman.
Cleveland, Rena.....Bozeman.
Donaldson, Jeanette..... Bozeman.
Dunckel, Emma..... Butte.
Durham, Ella..... Bozeman.
Elliott, Mrs. W. J.....Bozeman.
Ellis, Mabel Harlem.
Featherston, Ellis.....Bozeman.
Featherston, Beth..... Bozeman.
Feazelle, Grace..... Bozeman.
Flager, Ruth.....Red Lodge.
Freeman, Lorraine..... Bozeman.
Fuller, Ruth..... Bozeman.
Gottlob, Anna..... Howie.
Griffin, Grace Bozeman.
Griffith, Gladys Gebo.
Griffith, George Gebo.
Griffith, Gilbert Gebo.
Hartman, Flora Bozeman.
Hartman, Leah.. Jeffers.
Hollier, Alice.....Bozeman.
Hollier, Georgia..... Bozeman.
Hoy, Katherine..... Bozeman.
Jeffers, Bertha Jeffers.
Jones, Gladys..... Bozeman.
King, Bertha Livingston.
King, Gladys Bozeman.
Kirschner, Hortense.....Bozeman.
Knatz, Ione.....Fort Ellis.
Kountz, Mamie Bozeman.
Lewis, Arlene Dewey.
Lewis, Glenn.... Dewey.
Martin, Nellie.....Fort Ellis.
Martin, Bessie..... Bozeman.
Maynard, Frances.....Bozeman.
McCullough, Grace..... Gebo.
Metheney, Helen..... Bozeman.
Morrison, Bertha Bozeman.
Perrine, Carlotta.. Utica.
Piedalue, Alice..... Bozeman.
Quaw, Eugene Bozeman.
Rouleau, Adeline..... Butte.
Rouleau, Francis..... Butte.
Schumacher, Hettie Bozeman.
Slayton, Lydia Lavina.
Small, Nora Manhattan.
Smith, Martha.....Central Park.
Stewart, Mildred Bozeman.
Story, Clara.....Park City.
Swingle, Mrs. D. B.....Bozeman.
Switzer, Madge Bozeman.
Tannatt, Hazel..... Bozeman.
Thorpe, Florence Bozeman.
Veltum, Donna..... Logan.
Widener, Ethel..... Bozeman.
Wilson, Elva..... Bozeman.
Work, Vida Bozeman.
Zacher, Frieda.....Glenullin, N D.
—66.

VOCAL.

Anderson, Vera Bozeman.
Bancroft, Ross Oakley, Kan.
Brammer, Vergie Bozeman.
Bromley, Earl Bozeman.
Dammerell, Cora Bozeman.
Davidson, Mary Bozeman.
Ellis, Mabel Harlem.
Fransham, Mrs. W. J. Bozeman.
Freeman, Hazel Bozeman.
Hartman, Flora Bozeman.
Hartman, Will Bozeman.
James, John S. Cascade.
Kittams, Samuel Straw.
Lewis, Max Dewey.
Lovelace, Amy Bozeman.
Maynard, Frances Bozeman.
McKinzie, Charles Bozeman.
Oliver, Adelaide Bozeman.
Owenhouse, Mrs. E. J. Bozeman.
Reaves, Mrs. William Bozeman.
Robinson, Fred Bozeman.
Smith, Mrs. D. D. Bozeman.
Sutton, Mrs. Kate Bozeman.
Van Zandt, Carolyn Bozeman.
Widener, Carl Bozeman.
Zeigler, Ralph Bozeman.

—26.

VIOLIN

Bigelow, Alton Bozeman.
Bole, William Bozeman.
Calkins, Ethel Cody, Wyo.
Featherston, Ellis Bozeman.
Featherston, Beth Bozeman.
Fisher, Charles Bozeman.
Hammond, Bert Forsyth.
Kinney, Martha Bozeman.
Perkins, Lilian Bozeman.
Soper, Charles Bozeman.
Tschudy, Montie Billings.
Warwood, J. F. Bozeman.
Work, Lester Bozeman.

—13.

SUMMARY

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Counted Twice	37
Net Total	372

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Bulletin of THE MONTANA STATE COLLEGE OF AGRICULTURE *and* MECHANIC ARTS.

FOUNDED EIGHTEEN HUNDRED NINETY-THREE

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1907-'08

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Fifteenth

Annual Catalogue

Montana

State College of Agriculture

and Mechanic Arts

1907-1908.

Printed in office of Republican-Courier.
Bozeman, Montana.



Calendar.

1908.

Second Semester Begins 8:30 A. M., Monday, Jan. 27.
Washington's Birthday a Holiday.....Saturday, Feb. 22.
School of Agriculture Ends,.....Friday, April 3.
Arbor Day..... Tuesday, April 21.
Visitor's Day..... Friday, May 8.
Examinations Begin..... 9:00 A. M., Monday, May 25.
Decoration Day, a Holiday..... Saturday, May 30.
Baccalaureate Address..... Sunday, May 31.
Music Recital..... Monday, June 1.
Preparatory Department Graduation.....Tuesday, June 2.
Commencement Day..... Wednesday, June 3.
Registration and Examination for Entrance and Conditions
Monday and Tuesday.....September 14 and 15.
First Semester Begins.....Wednesday, Sept. 16.
School of Agriculture Begins..... Tuesday, Oct. 20.
Thanksgiving Recess Begins..... Thursday, Nov. 26.
Winter Vacation Begins..... Saturday, Dec. 19.

1909.

Winter Vacation Ends..... 8:30 A. M., Tuesday, Jan. 5.
Examinations Begin..... 9:00 A. M., Monday, Jan. 25.
First Semester Ends..... Saturday, Jan. 30.
Second Semester Begins..... 8:30 A. M., Monday, Feb. 1.
Washington's Birthday, a Holiday..... Monday, Feb. 22.
School of Agriculture Ends..... Friday, April 2.
Arbor Day, a Holiday..... Tuesday, April 20.
Decoration Day, a Holiday..... Sunday, May 30.
Examinations Begin..... Monday, May 31.
Baccalaureate Address..... Sunday, June 6.
Music Recital Monday, June 7.
Preparatory Department Graduation..... Tuesday, June 8.
Commencement Day..... Wednesday, June 9.

Montana State Board of Education.

GOVERNOR EDWIN NORRIS, (ex-officio chairman).....Helena.
ATTORNEY GENERAL ALBERT J. GALEN, (ex-officio).....Helena.
STATE SUPT. W. E. HARMON, (ex-officio) Secretary.....Helena.

By Appointment.

G. T. PAUL.....Dillon.
CHARLES N. KESSLER.....Helena.
(Term expires February 1, 1909.)
JOHN M. EVANS.....Missoula.
CHARLES R. LEONARD.....Butte.
(Term expires February 1, 1910.)
O. W. McCONNELL.....Helena.
E. O. BUSENBURG.....Lewistown.
(Term expires February 1, 1911.)
O. P. CHISHOLM.....Bozeman.
S. D. LARGENT.....Great Falls.
(Term expires February 1, 1912.)
B. T. HATHEWAY, Clerk of the Board.....Helena.

Executive Board.

In Charge of the College and Experiment Station.

JOHN M. ROBINSON.....Bozeman.
(Term expires 1908.)
E. B. LAMME.....Bozeman.
(Term expires 1909.)
E. BROOX MARTIN.....Bozeman.
(Term expires 1910.)
WALTER S. HARTMAN, President.....Bozeman.
(Term expires 1911.)
J. H. BAKER.....Bozeman.
(Term expires 1911.)
GEORGE COX, Secretary-Treasurer.....Bozeman.

Faculty.

JAMES M. HAMILTON, M. S., (Union Christian College) **President.**
Professor of Philosophy and Economics.

MRS F. E. MARSHALL.
Professor of Art.

WILLIAM F. BREWER, A. M., (Harvard University.)
Professor of English and Latin.

AARON H. CURRIER, A. M., (Oberlin College.)
Professor of French and German.

MISS LILLA A. HARKINS, M. S., (South Dakota Agr. College.)
Professor of Domestic Science.

ROBERT A. COOLEY, B. S., (Massachusetts Agr. College.)
Professor of Zoology and Entomology.

WILLIAM D. TALLMAN, B. S., (University of Wisconsin.)
Professor of Mathematics.

FREDERICK B. LINFIELD, B. S. A., (Ont. Agr. College.)
Professor of Agriculture.

WILLIAM M. COBLEIGH, A M., (Columbia University.)
Professor of Physics and Chemistry.

JOSEPH A. THALER, E. E., (University of Minnesota.)
Professor of Electrical Engineering.

GEORGE B. COUPER, M. E., (University of Minnesota.)
Professor of Mechanical Engineering.

E. TAPPAN TANNATT, B. S., (Washington State College.)
Professor of Civil Engineering.

WILLIAM J. ELLIOTT, B. S. A., (Ont. Agr. College.)
Professor of Dairying.

ALFRED ATKINSON, B. S. A., (Iowa State College.)
Professor of Agronomy.

ROY W. FISHER, B. S., (University of Idaho.)
Professor of Horticulture.

ROBERT W. CLARK, B. S. A., (University of Minnesota.)
Professor of Animal Industry.

CHARLES S. DEARBORN, B. S., (Kansas Agr. College.)
Associate Professor of Mechanical Engineering in Charge of Shops.

DEANE B. SWINGLE, M. S., (University of Wisconsin.)
Assistant Professor of Botany.

ROBERT D. KNEALE, B. S., (Purdue University.)
Assistant Professor Civil Engineering.

M. HERRICK SPAULDING, B. S., (Stanford University.)
Assistant Professor of Zoology.

MISS MARY A. CANTWELL,
Principal Preparatory Dept. and Instructor in English and Mathematics.

MISS HELEN R. BREWER, A .B., (Iowa College.)
Instructor in History and Latin.
MRS. MABEL KINNEY HALL, Ph. B., (Oberlin College.)
Instructor in Public Speaking and Modern Languages.
MISS FLORENCE BALLINGER,
Instructor in Sewing.
FRANK W. HAM, M. S., (Mont. Agr. College.)
Instructor in Chemistry and Physics.
CHARLES E. MOLLETT, Ph. C., (Kansas State Univ.)
Instructor in Pharmacy and Chemistry.
MRS EDNA GAGE,
Assistant in Art.
MISS FRIEDA BULL, B. S., (Mont. Agr. College.)
Assistant in Mathematics.
MISS LUCILE BREWER,
Assistant in Domestic Science.
EDWARD D. KINNEY, B. C. E., (Mont. Agr. College.)
Assistant in Civil Engineering.
MISS ARABELLE U. BARNES, (Wooster University.)
Acting Head of Music Department and Instructor in Piano.
MISS REGINA BARNES, (Wooster Conservatory.)
Instructor in Piano.
MISS PHYLLIS PAULINE WOLFE, (New England Conservatory.)
Instructor in Vocal Music.
GEORGE W. HEY, Mus. Bac., (Syracuse University.)
Instructor in Violin.
MRS. MARY K. WINTER,
Librarian.
GEORGE R. CALLAWAY,
Secretary and Accountant.

STANDING COMMITTEES OF THE FACULTY.

AGRICULTURE—Linfield, Atkinson, Cooley, Fisher, Elliott, Clark.
ASSEMBLY—Mrs. Hall, Mrs. Marshall, Miss Wolfe.
ATHLETICS—Tallman, Currier, Atkinson.
BUILDINGS—Tannatt, Clark, Burke.
COMMENCEMENT—Hamilton, Currier, Mrs. Hall, Miss Cantwell, Miss Brewer, Miss A. Barnes.
ENGINEERING—Thaler, Couper, Cobleigh, Tannatt, Dearborn, Kneale.
GENERAL SCIENCE—Cobleigh, Tallman, Brewer, Cooley, Miss Harkins.
LIBRARY—Hamilton, Cobleigh, Thaler.
PUBLICATION—Brewer, Miss Cantwell, Cooley, Couper, Fisher.
SCHEDULE—Tallman, Miss Cantwell, Couper.
STUDENT AID—Hamilton, Miss Harkins, Miss Cantwell, Elliott, Thaler.
STUDENT ORGANIZATIONS—Mrs. Hall, Currier, Brewer, Atkinson, Miss Brewer.

The Agricultural Experiment Station.

STATION STAFF.

F. B. LINFIELD, B. S. A., Director.
R. A. COOLEY, B. S., Entomologist.
R. W. FISHER, B. S., Horticulturist.
E. TAPPAN TANNATT, B. S., Engineer.
W. J. ELLIOTT, B. S. A., Dairyman.
ALFRED ATKINSON, B. S. A., Agronomist.
ROBERT W. CLARK, B. S. A., Animal Industry.
EDMUND BURKE, B. S. Meteorologist and Chemist.
DEANE B. SWINGLE, M. S., Assistant Botanist.
HARRY O. BUCKMAN, B. S. A., Assistant Agronomist.
ROBERT D. KNEALE, B. S., Assistant Engineer.
JOHN B. NELSON, Superintendent Dry Farm Work.

In connection with the College, the Montana Agricultural Experiment Station has been established. The object of this station is to further the interests of the agricultural industries of the State of Montana. This is done by conducting researches and experiments which may include the physiology of plants and animals; the diseases to which they are severally subject, with remedies for the same; the chemical composition of useful plants at their various stages of growth; the various subjects connected with irrigation; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soil and water; the chemical composition of manures, natural and artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly upon the agricultural industry of Montana as may seem advisable.

The experiment station farm, consisting of 390 acres, adjoins the college grounds. It is provided with the necessary barn, granaries, tool houses, farm implements, live stock, gardens, greenhouses and orchards.

Sub-stations for experimental work in dry farming are maintained in various parts of the state and are conducted in co-operation with the railroads and the United States Department of Agriculture. A sub-station

for experiments in fruit culture has been established in the western part of the state during the year.

The Montana Experiment Station is supported by the annual appropriations from the Federal government under the Hatch and Adams Acts, supplemented by the state.

The station issues during the year a series of bulletins, which put in practical form the results of the experimental work. These are sent, upon request, to any citizen of Montana who will apply for them, and any such may have his name entered upon a mailing list, and receive all bulletins as soon as issued.

Address: Director Experiment Station, Bozeman, Montana.

The College of Agriculture and Mechanic Arts.

AIM AND SCOPE.

The purpose of the colleges of agriculture and mechanic arts is chiefly to provide industrial education in agriculture, engineering, household economy, and applied science, for the young men and women of the respective states in which they are located. The scope of the Montana Agricultural College is set forth in the two so-called Morrill Acts of Congress, which authorized this class of institutions and supplied in part endowment and funds for maintenance; and in an Act of the Montana Legislature accepting the land and money grants from the national government and guaranteeing the state's portion of the financial support.

The first Morrill Act of Congress of July 2, 1862, making a land grant for the partial endowment of the agricultural and mechanical colleges states that the income from these lands shall be used to maintain colleges "where the leading object shall be, without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

The second Morrill Act of Congress, August 30, 1890, making an annual appropriation out of the treasury of the United States for the further support and endowment of these colleges, provides that this fund is "to be applied only to instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural and economic sciences with special reference to their application to the industries of life;and to the facilities for such instruction."

The Act of the Montana Legislature, approved February 16, 1893, accepts these grants of lands and money and states that the Montana Agricultural College shall have for its object "instruction and education in the English language, literature, and mathematics, civil and mechanical engineering, agricultural chemistry, animal and vegetable anatomy and physiology, the veterinary art, entomology, geology and such other natural sciences as may be prescribed by the State Board of Education; political, rural and household economy, agriculture, horticulture, history, bookkeeping and especially the application of science and the mechanical arts to practical agriculture in the field, and irrigation and the use of water for agricultural purposes."

ENDOWMENT.

The Enabling Act, providing for the admission of Montana into the Union, approved February 22, 1889, Sec. 16, grants 90,000 acres of land



MONTANA COLLEGE OF AGRICULTURE AND MECHANIC ARTS.



COLLEGE HALL.

to Montana for the use and support of an agricultural college according to the terms of the Act of Congress, July 2, 1862, and Sec. 17, grants an additional 50,000 for the same purposes, and subject to the same conditions and limitations as the other grant. The 140,000 acres of land cannot be sold at a price less than $10.00 per acre, and the principal, together with all money received from the sale of timber, invested as a permanent endowment. The unsold lands may be leased and the rentals together with the interest on the permanent endowment shall be used for the maintenance of the college.

The Act of Congress of August 30, 1890, appropriates $25,000 annually out of the treasury of the United States. By the Nelson bill, passed March, 3, 1907, this amount is increased annually by $5,000 each year, beginning in 1907, until the total annual appropriation shall reach $50,000, at which figure it shall remain.

Both the Acts of July 2, 1862, and August 30, 1890, contain this clause: "No portion of the funds, nor the interest thereon, shall be applied, directly or indirectly, under any pretense whatever, to the purchase, erection, preservation, or repair of any building, or buildings." The State must appropriate money for the following purposes: Buildings, repairs, furniture, fuel, light, water, insurance, printing, salary of all the employes other than the faculty, and the administrative expenses.

LOCATION.

Bozeman, the county seat of Gallatin county, is on the main line of the Northern Pacific railroad. For convenience, healthfulness and beauty of surroundings, the location is unsurpassed. The college is situated on an elevation which commands a view of one of the most fertile valleys in the world, covered far and wide with grain fields and hemmed in on all sides by lofty mountains.

Bozeman is a city of homes and churches, with a wholesome moral environment. It is a most desirable residence city for families who wish to educate their children. Expenses are moderate and there are all the conveniences of a modern city.

CAMPUS AND FARM.

The grounds and farm contain three hundred and ninety acres. Forty acres in the immediate vicinity of the buildings constitute the campus and recreation grounds, which are in lawn, interspersed with flower beds, shrubbery, trees and driveways. The remainder is used for farming and experimental purposes.

BUILDINGS.

College Hall, situated in the center of the college campus is a substantial structure of brick and stone of practically fire proof construc-

tion, having a total length of one hundred and twenty-eight feet and a width of ninety feet. It is three stories high, and has a basement, which furnishes quarters for mechanical drawing and three class rooms. The first floor contains the library, two offices and three large class rooms. The north half of the second floor is devoted to the art department, the arrangement being such that three large rooms can be thrown together, by sliding doors, for exhibition purposes. The south half of the second floor is used by the department of civil engineering and irrigation, and has two offices, two recitation rooms and a drawing room. The third floor contains the large assembly hall, a literary hall and five class and music rooms. The building commands a magnificent view of the Bridger and Gallatin mountains and the whole of the beautiful Gallatin valley. The building is heated with steam and lighted with electricity from the generator in the power house.

Agricultural Hall is a three story building, one hundred and fifty feet by sixty-eight feet, pressed brick, tile roof, maple floors and modern equipment throughout. The north half of the first floor contains the quarters for veterinary science, consisting of storerooms, office, class room and three laboratories. The south half of this floor is used for horticulture and has seed room, office, class room, work room and laboratory. Connecting with these rooms on the south is a battery of three greenhouses, each fifty feet by twenty feet. The north half of the second floor is occupied by the agronomy department with office, class room, dry land office and two large laboratories. In the south half are offices for the director of the experiment station, superintendent of farmers' institutes, class room, office and laboratory for the department of animal industry. The third floor is devoted to domestic science and contains two large kitchens, two dining rooms, two class rooms, sewing rooms and parlor. This building will be occupied in September, 1908.

The Chemistry and Physics Building is located west of the College Hall. It is sixty by one hundred feet, of pressed brick, and is three stories high including the basement. The basement is occupied by the physics lecture room, pharmacy lecture room and laboratory, the mineralogical and assay laboratory and the museum of geology and mineralogy. The main floor is occupied by the office and department library, a lecture room, a preparation room, and the experiment station laboratory. The east half of the second story contains the laboratories for physics, and the west half, the qualitative and the quantitative laboratories. The north tower is used for the meteorological observatory, and a fine set of registering instruments is installed in it.

The Biology Building, consisting of three stories and basement, is brick veneered. On the top floor is a lecture room and a museum containing the zoological collections. On the floor below are three laboratories

for bacteriology, botany and zoology, and an office and work room for the botanist. The west half of the first floor is a large laboratory for general biology and the east half is occupied by the office, library, and work room for the entomologist. The basement contains work rooms, class room, store rooms, herbarium room and dark room. Attached to this building on the south is a greenhouse, 50 by 36 feet, for botanical purposes, and an insectary, 18 by 10 feet, for the study of living insects.

The Engineering Laboratory is a two story stone building, 55 by 33 feet, with a frame annex 36 feet by 20 feet. The first floor contains the dynamos, motors, two steam engines and strength and material testing machines. The second story is occupied by the storage battery photometer and electric light rooms, class room and the office of the professor of electrical engineering. The first floor of the annex contains the cement laboratory and a small class room, and the second floor is used for electrical designing.

The Shop Building is a one story frame structure, 60 by 100 feet, with an annex 36 by 50 feet. It contains a forge room and foundry, 27 by 60 feet, a machine shop, 44 by 72 feet, an office, a wash room and a tool room. The wood shop is in the annex. Nearby stands a small building for the traction engines.

The Power House is a brick structure, 32 by 76 feet, centrally located with reference to the principal college buildings. It contains an eighty horse-power tubular boiler, a one hundred and twenty-five horse-power Root water-tube boiler, a sixty horse-power engine, directly connected with a forty K. W. commercial dynamo, and coal storage bins. The engine and generator furnish power for electric lights, the ventilating fans, the shop and laboratory machinery.

The Drill Hall is a frame building, 100 by 60 feet, with two roms each 14 by 12 feet on the south end, fitted with shower and needle baths. This building is heated and lighted and has a good floor for gymnasium work. In the south end are two dressing rooms, each 28 by 12 feet. Along each side is a set of four rows of permanent seats, amphitheater style. The hall furnishes a convenient place for basket ball and other indoor athletics.

The Cattle Barn is a two story frame building, 120 by 86 feet, and of fine architectural appearance. On the first floor is the dairy stable, quarters for breeding and young stock, a stock judging room, 40 by 40 feet, box stalls, feed bins and offices. The second story is used for storage of hay. All stables have cement floor and iron stalls.

The Dairy Building is a two story frame structure, 25 by 40 feet, with a one story wing, 20 by 40 feet. On the first floor are the butter and cheese making rooms, store rooms, and offices. In the wing are the boiler

and engine room, fuel room and ice house. On the second floor are a milk testing laboratory and a class room.

The Horse Barn is a two story frame building, 86 by 44 feet. It contains a living room, carriage room, feed bins, fourteen single stalls, three double box stalls, and space for 100 tons of hay.

The Seed Barn and Granary is a two story building and affords ample storage room for the field crops on the station farm.

The Piggery consists of a main building, 30 by 35 feet, with two wings, 16 by 50 feet each. In the main building are the feeding rooms and slaughter room, while the wings provide six pens each, for the hogs.

The Poultry Plant consists of two buildings. The first is 122 feet long by 15 feet wide. In the center is an office and feed room, under which is the incubator cellar and heating plant. One wing is a brooder house, the other contains six pens, with yards 100 feet long on either side. The other building is 120 feet long and contains eight pens with yards.

The Station Heating Plant is a neat brick structure just west of the station building, which furnishes the steam for the buildings grouped about the station. The department of animal industry has an office and class room in this building.

GOVERNMENT.

The State Board of Education has general control and supervision of the college. The immediate direction and control is vested in an Executive Board of five members appointed by the governor.

EXPENSES.

There are no dormitories connected with the college. Students find room and board in private families convenient to the college at from $18.00 to $22.00 per month. A list of approved places with prices and accommodations is kept in the president's office. A committee of students meets all trains on registration days and at other times on request and aids in finding satisfactory locations. The total expense for the year for tuition, room, board, books and incidental expenses may be estimated at $200 to $300.

EMPLOYMENT FOR STUDENTS.

A number of students earn a part of their expenses while in college. Students expecting to work thir way should come with sufficient money to pay their expenses for one semester unless they have engaged work in advance. The college cannot guarantee employment, but those who are willing to give efficient, faithful service have usually found work.

A few students are employed as janitors and as assistants in the shops, laboratories and barns. Others care for furnaces, horses and cows

in the city, work in stores and at various kinds of house work. Calls for young lady students to work for their board are numerous.

Students readily find employment at profitable wages during the summer vacation. A large number annually get work with the transportation companies in the Yellowstone National Park as drivers, camp attendants and domestics. Engineering students are placed with the reclamation service, the railroads and the electric power plants.

A faculty committee aids students to find employment. Those desiring work should write, stating experience and kind of work desired.

FEES.

1.—Annual matriculation fee for College, Preparatory, Pharmacy, Art and One Year Home Science Course	$12.00
2.—Annual matriculation fee for School of Agriculture	6.00
3.—Annual matriculation fee for Four Weeks Course in Dairying and Short Agricultural Courses	2.00

DEPOSITS.

Agriculture, dairying, soil physics or soil fertility, per semester	$ 2.00
Art, preparatory or college courses, per semester	1.00
China painting, per semester	5.00
Biology, preparatory, per year	2.00
College botany and zoology, per semester	1.50
Bacteriology and Histology, per semester	4.00
Chemistry, freshman, per year	8.00
Organ., Food and Min., per semester	5.00
Qual. and quan., per semester	6.00
Physical chemistry, per semester	2.00
Assaying, per semester	25.00
Engineering, college shop courses, per year	6.00
Preparatory and agricultural shop courses, per year	4.00
Laboratory, per semester	3.50
Surveying and cement testing, per year	1.50
Civil engineering, drafting, per year	1.00
Home Science, preparatory or college, per year	3.00
One year course, per year	3.00
Sewing, per year	.50
Physics, preparatory, per year	1.00
College, per year	2.00

A fee is a fixed charge and no part of the fee is returned to the student. The deposits in most cases are intended to cover the cost of materials and breakage of equipment in the laboratory and any balance of the deposit not required for this purpose is returned to the student at the close of the semester or year.

ADMISSION.

Admission to the freshman class, in any of the college courses, is granted: (a) By a certificate of graduation from an accredited high school, (b) By examination in the subjects required by the college for entrance, (c) By faculty approval of grades from other than accredited high schools, (d) By graduation from the preparatory school.

Candidates for admission to the preparatory department, the one year course in domestic science, the school of agriculture and mechanic arts, must have completed the eighth grade in the public schools or its equivalent. There are no set requirements for art, music and the short agricultural courses, all being admitted who give evidence of being able to profit by the work.

ENTRANCE REQUIREMENTS.

Fourteen units are required for admission to the freshman class in any college course.

Any one with not less than thirteen units may be admitted conditionally, but the unit of preparatory work which has not been offered must be given preference over college subjects.

A unit for admission shall consist of work to the amount of five recitation periods per week of forty-five minutes each, or of four recitation period per week of sixty minutes each, for a year of not less than thirty-six weeks.

Two periods of laboratory, shop work or drawing shall count as one recitation.

The following seven units are required of all applicants:

English.....3
Physics.....1
Mathematics.....3

The remaining seven units shall be presented from the following list:

English.....1
German 2 or 3
French 2 or 3
Latin 2, 3 or 4
Biology, or Botany, or Zoology..1
Trigonometry ½
Physiology ½
Phys. Geography ½
Chemistry 1
General History 1 or 2
English History.....1
American History 1
Freehand Drawing 1
Bookkeeping 1
Stenography 1
Agriculture 1 or 2
Mechanical Drawing 1
Manual Training.....1 or 2
Domestic Science.....1 or 2

REGISTRATION.

Registration and Assignment of Work.—All students are registered in the president's office, and each one is then assigned to a member of the faculty, called a class officer. The class officers arrange the studies and it is their duty to advise with the students regarding all quetions

which arise in connection with their studies and to investigate complaints of unsatisfactory work. Students should consult with the class officers when in need of assistance or information.

Amount and Regularity of Work.—Students under twenty-one years of age will be admitted only to regular courses or to work as nearly regular as their preparation allows, unless on special action of the faculty. Students over twenty-one will be admitted to such work, not less than twelve credits, (allowance being made for music) as the schedule permits and their class officers approve.

Change of Registration.—A student desiring to change his studies will present his request to his class officer, who, after consulting all teachers interested, will take such action as he may deem best. Change in registration will be made after four weeks for extraordinary reasons only. Requests for change in registration will not be consideed during the last eight weks of a semester.

A change in course of study is allowed by a vote of the faculty only.

ATTENDANCE.

Attendance—A student tardy or absent from any class will present the reason for the tardiness or absence at the first appearance at such class after the tardiness or absence occurred. The teacher will be the judge of the sufficiency of the excuse. A student absent from class the third consecutive time will be reported to the class officer and the president. A student who has been three times absent (two tardinesses counting as one absence) and is unable to present a satisfactory excuse is immediately suspended and will be reinstated only by vote of the faculty.

Leave of Absence—When it is necessary for a student to be absent from the city application must be made to the president for leave of absence. A leave of absence is a justification for absence from class but does not give relief from the work omitted.

GRADES.

Passing Grades—An average standing from 90 to 100 is A, from 80 to 90 is B, from 70 to 80 is C, from 60 to 70 is D.

All students, one half of whose work shall have received the grade of A, will be recommended for the degree "With Honors."

Conditions and Failures—An average standing of less than fifty per cent for any semester's work shall be termed a "failure," and the work must be made up by repeating the subject the following year. An average standing for the semester of more than fifty per cent and less than sixty per cent shall be termed a "condition." A condition must be removed by a special examination before the beginning of the semester in which the subject is next taught. If not removed within this limit the condition shall become a failure, to be made up by immediately repeat-

ing the subject. Examinations for removing conditions shall be held on the Monday and Tuesday preceding the beginning of the college year, and on the last Friday and Saturday of each semester, and at no other time. Laboratory work falling below the grade in quality or quantity shall be marked deficient and shall be made up within the same time limit as conditions.

Students whose work is unsatisfactory will be reported to the class officer and the president and information will be sent to the parents or guardians.

Credits—For convenience in estimating the requirements for a degree, the following rules are laid down: One hour a week, for a semester, of recitation or lecture work, or two and one-half hours a week, for a semester, of laboratory, shop, library work, or drawing, shall count as one credit.

If for any reason the full time is not occupied in the shop, laboratory, drawing room or library, the remainder shall be used under the supervision of the instructor for outside work.

No regular student may take in any one semester work amounting to less than twelve credits, nor more than nineteen, unless a greater number are prescribed in the course.

GRADUATION AND DEGREES.

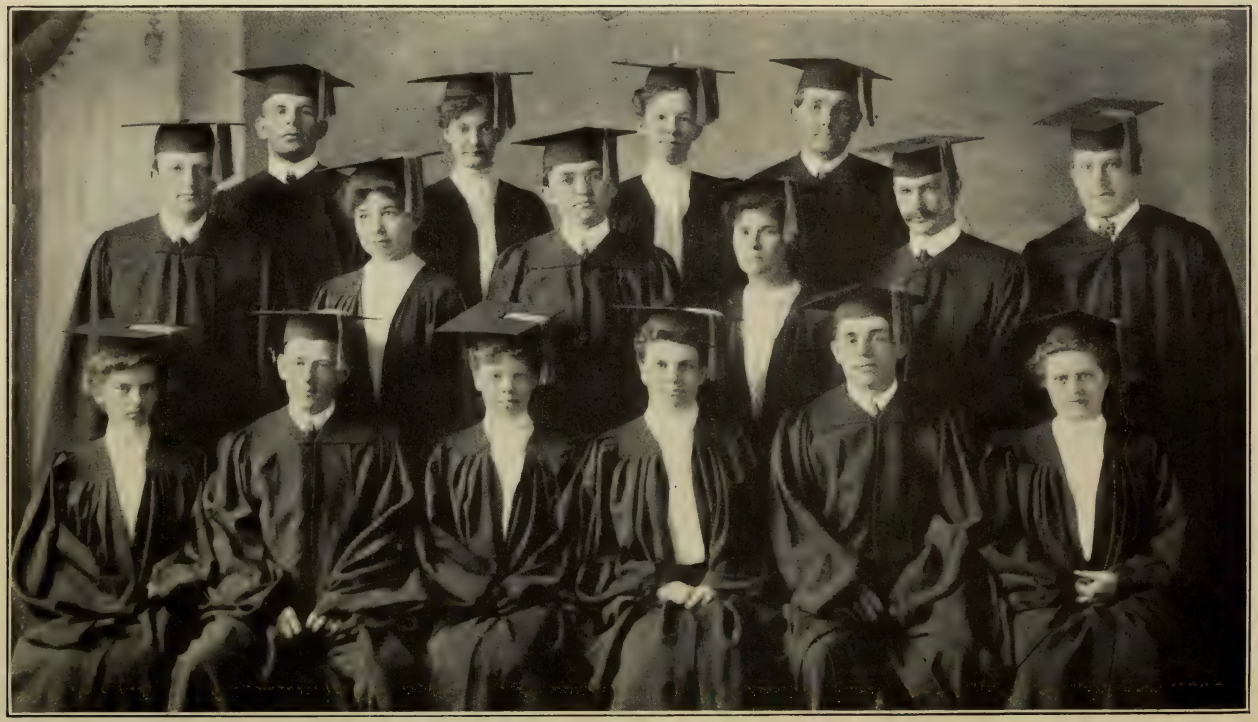
Bachelor's Degree—Candidates for the bachelor's degree must complete satisfactorily one of the college courses as outlined and not less than 130 credits; including also a thesis, the value of which in credits shall be determined by the instructor concerned. Students who are relieved for any reason of the requirements in military drill shall present four additional credits in some other subjects.

The degree of Bachelor of Science is conferred upon those completing the work prescribed in (1)Biology, (2) Chemistry, (3) Civil Engineering, (4) Electrical Engineering, (5) Forestry, (6)Home Science, (7) History-Literature, (8) Mathematics-Physics, (9) Mechanical Engineering, (10) Pharmacy.

The degree of Bachelor of Scientific Agriculture is conferred upon those completing the work prescribed in (1) Agronomy, (2) Animal Industry, (3) Dairying, (4) Horticulture.

Advanced Degrees—The candidate must hold a bachelor's degree from this college or another of equal rank, and in the line of work for which he applies for the master's degree, or he shall have sufficient preparation in his major subject to enable him to carry on research work. He shall complete one full year of resident study of not less than 32 credits.

There shall be one major subject and one or two minors, the major being equal to 10 credits per semester. The plan of the work must be approved by the committee on graduate work by October 1. The candidate shall also present a thesis embodying the results of original research,



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which may be a part of the credits required for the major subject.

The engineering degrees will be conferred on candidates properly prepared who have had three years professional work in responsible positions and who present an acceptable thesis.

MISCELLANEOUS.

Government—Students are expected to conduct themselves as ladies and gentlemen; those who fail to comply with this demand will be requested to leave the institution.

Work for Exhibition—It is required that students who have done work suitable for exhibition purposes shall place such work at the disposal of the institution for the period of two years.

Assembly—Students are required to attend the weekly assembly, at which lectures are delivered by members of the faculty and others.

Student Organizations—All public performances given by students or student organizations, using the name of the college, will be under the supervision of the committee on student organizations.

Military Drill—All male students, except aliens, those physically disqualified, members of the junior and senior classes, and student assistants, are required to take military drill, satisfactory work being requisite for graduation.

Honorable Dismissal—Students intending to sever their connection with the institution, either indefinitely or permanently, should report as soon as possible to the president, either in person or in writing, giving proper explanation, and should apply for an honorable dismissal. Students leaving the institution without such honorable dismissal (except at the end of the college year) will not be re-admitted to the college at any later time, nor will any reports or grades in credit for work done here be sent out until satisfactory explanation is made.

ACCREDITED HIGH SCHOOLS.

Following is a list of the accredited high schools of the state:

(1) **City High Schools**—Anaconda, Billings, Butte, Chinook, Columbus, Forsyth, Fort Benton, Great Falls, Hamilton, Havre, Helena, Virginia City and Whitehall.

(2) **County High Schools**—Beaverhead, Dillon; Broadwater, Townsend; Carbon, Red Lodge; Custer, Miles City; Dawson, Glendive; Fergus, Lewistown; Flathead, Kalispell; Gallatin, Bozeman; Granite, Philipsburg; Jefferson, Boulder; Missoula, Missoula; Park, Livingston; Powell, Deer Lodge; Sweet Grass, Big Timber; Teton, Chouteau.

COLLEGE ORGANIZATIONS.

Young Men's Christian Association—The association is undenominational and is well fitted to promote the moral and religious life of stu-

dents. It conducts mission and Bible study courses, prayer meetings and secures addresses by religious worker. The association promotes good fellowship by giving social entertainments, assists new students to get started in college life and aids in securing employment for those who wish to work their way through college.

Young Women's Christian Association—The object of this association is the all round development of Christian womanhood. It co-operates with the Y. M. C. A. in its social and religious work among the students. It conducts devotional meetings and carries on systematic Bible study. Several delegates are sent to the Northwestern Conference each year and an active interest is maintained in the state association.

Both associations have neatly furnished rooms in which to hold meetings and transact business.

Literary Societies—Three literary societies are maintained, the Arena for college young men, Hamiltonia for college young ladies and the Philomathion for preparatory students. Each society is in a flourishing condition, holding regular meetings. They give most excellent opportunity for practice in compositon, declamation,, oratory, debate and music.

Oratorical Association—This organization has charge of all declamatory, oratorical and debating contests, both between classes in the college and with the institutions which are comprised in the State Oratorical Association. All students are members of this association.

Engineering Society—This society admits as active members, all students in the regular college courses in engineering and as associate members, students taking engineering studies. The object is to increase interest in technical education by discussing the current questions and problems of the profession, and to aid its members financially by purchasing at wholesale rates, books, materials and instruments.

College Choristers—This glee club of twenty voices has attained a high degree of skill in rendering popular and high class music. The annual concert is one of the chief events of the college year. Professor F. Arthur Oliver is the conductor. A splendid opportunity is given students to cultivate their musical talent.

The Exponent—A monthly publication, in magazine form, under this name, is maintained throughout the college year entirely under student supervision and control. The editor-in-chief is elected annually by the student body. He appoints the staff from among those students who have taken interest in the paper and been its best contributors. The Exponent is the organ of the students and contains literary, society, local, exchange and athletic departments.

Athletic Association—This association has general control of all athletic interests of the college, subject to the approval of the faculty. Base ball, basket ball, track and tennis are maintained. A part of the annual matriculation fee is appropriated to athletics and all students thus

become members of this association without additional cost.

Branch of the American Institute of Electrical Engineers—A branch of this society has been organized at the college. Regular monthly meetings are held, at which original papers are read or those of the Institute discussed. Students and teachers are kept in touch with practical engineers and their problems. Only regular members or student members of the American Institute are eligible to membership in this branch. There is, however, an Electrical Club which includes all the members of the Institute and all other students in the electrical engineering course.

College Band—The college band of forty-five members, under the instruction of Mr. Louis Howard, is one of the best amateur musical organizations in the state. The college provides instruments, music and instruction. The band is divided into two sections, beginners and experienced players. This gives a splendid opportunity both for those who have never played and those who have some skill in the use of instruments.

PRIZES.

Chisholm Prize in Oratory—An annual prize of twenty dollars was founded several years ago by the Hon. O. P. Chisholm, a member of the State Board of Education, for the winner in the annual local oratorical contest. This is open to all students.

Armstrong Prize in Declamation—Hon. F. K. Armstrong, of Bozeman, gives a prize of ten dollars for the winner of the annual declamatory contest of the preparatory school. There is also a second prize of five dollars. Only regular students are eligible.

J. W. Pace Stock Judging Cup—J. W. Pace, of Helena, gives a cup to the winner in the students' stock judging contest, which is open to all agricultural students.

Zenoleum Medal—The Zenoleum Company gives a medal to the winner in the local stock judging contest.

Edison Medal—Seniors in electrical engineering are eligible to compete for the Edison medal. This medal was established at the twenty-fifth anniversary of the incandescent lamp and is awarded annually by the American Institute of Electrical Engineers. Competition is open to students in colleges of engineering having recognized standing.

SCHOLARSHIPS.

The State Board of Education has established a four year scholarship in each of the accredited high schools for the student who receives the highest average grade in his class. These scholarships are awarded each year by the high school principals for their respective schools. This scholarship excuses the holder from paying any tuition or deposits. Any one winning a scholarship may choose any of the state institutions.

MILITARY DRILL.

The Act of Congress, July 2, 1862, makes military drill a requirement in all land grant colleges. The United States government details a regular army officer to each institution and furnishes the necessary equipment of guns and ammunition.

Military drill is required of all male students except members of the junior and senior classes and those physically disqualified. All students taking drill are required to purchase the prescribed uniform. The cost of the uniform, including cap, is from $13.00 to $17.00, according to the quality of the cloth.

The uniforms are ordered by the college after the students register. Those expecting to take military drill should take this into consideration when purchasing clothing.

The names of the three cadets in the graduating class who have the highest grade of merit are reported to the war department for insertion in the U. S. Army Register. In making appointments from civil life to the regular or volunteer army, preference is given to those who have their names so recorded.

LIBRARY AND READING ROOM.

These are two large and well-lighted rooms on the first floor of College Hall. The library contains 9,300 well selected books, not counting public documents, and about 6,000 pamphlets. Its shelves are well supplied with standard works in technology, history, science and literature. About fifteen hundred dollars is spent yearly on books and magazines. The following periodicals are to be found in the room:

American Blacksmith; American Chemical Journal; American Historical Review;; American Homes and Gardens; American Journal of Mathematics; American Journal of Pharmacy; American Journal of Science; American Machinist; American Veterinary Review; Analyst; Anatomischer Anzeiger; Annals of Botany; Annals of Mathematics; Atlantic Monthly; Annals of the Am. Soc. of Political Science; Berichte der Deutschen Chemischen Gesellschaft; Bon Ton; Boston Cooking School Magazine; Botanical Gazette; Botanisches Centralblatt; Breeders' Gazette; British Gardening; Bulletin of the Torrey Botany Club; Canadian Entomologist; Cassier's Magazine; Cement Age; Cement World; Chemical Engineer; Century Magazine; Chemical News; Chicago Dairy Produce; Country Life; Delineator; The Dial; Dietetic and Hygienic Gazette; Die Elektrotechnische Zeitung; Economic Geologist; Education; Educational Review; Electrical World and Engineer; Electrician, (London); Electrical Railway Review; Engineering Magazine; Engineering News; Engineering Record; Engineering Review; Engineering Contracting; Entomological News; Entomological Monthly Magazine; Fliegende Blaetter; Forum; Gardener's Chronicle; Good Housekeeping; Harper's Bazaar; Harper's

Magazine; Harper's Weekly; Hoard's Dairyman; Home Companion; Illustration; Intercollegian; Irrigation Age; Journal of the Institute of the Electrical Engineers; Journal of New York Entomological Society; Keramic Studio; L'Art de la Mode; Ladies' Home Journal; Library Index; Library Journal; Literary Digest; London Live Stock Journal; Machinery; McClure's Magazine; Modern Housekeeping; Modern Language Notes; Modern Priscilla; National Geographic Magazine; New York Produce Review; The Nineteenth Century; The North American Review; Orange Judd Farmer; Outing; Outlook; Philosophical Magazine, British; Physical Review; Popular Science Monthly; Power; Psyche; Putnam's Monthly; Railway and Locomotive Engineering; Records of the Past; Reliable Poultry Journal; Review of Reviews; Saturday Evening Post; Sanitary Engineering; School Science and Mathematics; Science; Scientific American; Science Abstracts, Secs. A and B; Scribner's; Sibley Journal of Engineering; Speaker; Success; Table Talk; Technical World; Ueber Land und Meer; Western Electrician; What to Eat; Woodcraft; World's Work; Youths' Companion; Zeitschrift fur Analytische Chemie; Zoological Record; Zoologische Anzeiger.

The following periodicals are donated:

Bulletin of the Bureau of Labor; Climate and Crop Service, Mont. Sec.; Department of Labor; Experiment Station Record; Farmer; Farm and Voice; Industrialist; Indiana Farmer; Monthly Weather Review; National Stockman and Farmer; Northwest Agriculturist; Patent Office Gazette; School of Mines Quarterly.

The following newspapers are also to be found in the reading room. Most of them are donated:

Anaconda Standard; Basin Progress; Belt Valley Times; Big Timber Pioneer; Bozeman Chronicle; Butte Evening News; Dillon Tribune; Farm and Floral World; Farmers' Voice; Fergus County Argus; Forsyth Times; Great Falls Leader; Inland Empire; Inter Lake; Kendall Miner; Madisonian; Montana Daily Record; Montana Homestead; Montana Sunlight; Pacific Homestead; Phillipsburg Mail; Red Lodge Picket; Republican-Courier; Rocky Mountain Husbandman; Salt Lake Tribune; Townsend Star; The Times; Tri-County News; Western News.

Public Depositary—By Act of Congress the library in now a depositary and receives all public documents and other printed matter issued by the United States government.

Organization of Instruction.

A. The following four year college courses, each leading to the appropriate bachelor's degrees, are offered:

1.—Division of Agriculture.
1, Agronomy; 2, Animal Industry; 3, Dairying; 4, Horticulture and Forestry.

2. Division Engineering.
1, Civil Engineering; 2, Electrical Engineering; 3, Mechanical Engineering.

3. Division of Science.
1, Biology; 2, Chemistry; 3, Home Science; 4, History-Literature; 5, Mathematics-Physics; 6, Pharmacy.

B. The following courses, not leading to a bachelor's degree, are offered:

1. Preparatory School.
2. School of Agriculture.
3. School of Pharmacy.
4. Art School.
5. Music School.

C. The following special courses are offered.

1. Household Economy.
2. Agriculture.
3. Dairying.

Division of Agriculture.

Four year college courses are maintained in (1) Agronomy, (2) Animal Industry, (3) Dairying, (4) Horticulture and Forestry. The aim is to give a scientific and practical training for the agriculturist, the horticulturist, the dairyman, the stockman, and the forester. The work is the same for the first two years with the exception of forestry. At the end of the sophomore year the student chooses the group which he desires to make his specialty. The courses in agronomy, animal industry, dairying and horticulture lead to the degree of Bachelor of Scientific Agriculture. The course in forestry leads to the degree of Bachelor of Science.

AGRICULTURAL COURSES.

FRESHMAN.

French or German	4	French or German	4
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
General Botany (Biol. 9)	5	Plant Phys. and Histology (Biol. 10)	4
Trig. and Logarithms (Math. 2)	3	Prin. of Horticulture (Hort. 1)	3
Farm Dairying (Dairy 1)	3	Animal Types (An. Ind. 1)	3
Drill	1	Drill	1
	20		19

Course in Agronomy.

Agronomy is the science of the field and its crops. It treats of the production and improvement of field crops, the cultivation of soils and the maintenance of their fertility; and general farm management, which is the application of economic business methods to farm practices.

Because of the peculiar agricultural conditions existing in western states, a new agriculture has to be developed. The handling of dry farming lands is necessary only in the West. The problems which have to do with irrigation water, and the cultivation of the soil and management of the crops under irrigation must be solved by western investigators and agriculturists. It is to fit men to deal with these and other questions of production on the farm that this course is offered.

The first two years of the agronomy course are devoted to the study of the natural sciences, languages and some general agricultural work. This places the student in a position to appreciate and intelligently discuss the methods of practice taken up later in the course.

The last two years of the course are designed to give the student clear insight into methods for the cultivation and maintenance of the fertility of the soil; the peculiarities of the growth and handling of different crops; the arrangement, the laying out of the farm, and the principles which govern successful farm management.

With a constantly growing appreciation of the value of the agricultural lands of the west, comes an active demand for young men trained along the lines of practical and scientific agronomy, men who combine college training with practical experience and native ability. Such training is offered to young men in this course. The demand for such students is unlimited, at a compensation not exceeded in any other calling. A few of the many lines open to graduates of this department are: College and experiment station work, agricultural journalism, management of large irrigated and dry farms, management and salesmanships for seed firms, and superintendencies for companies with large land holdings.



AGRICULTURAL HALL.



BIOLOGY BUILDING.

COURSE IN AGRONOMY.

SOPHOMORE YEAR.

English Composition (Eng. 1)....2	
Organic Chemistry (Chem. 5)....3	English Composition (Eng. 1)....2
Qualitative Anal. (Chem. 2).....4	Agri. Chemistry (Chem. [illegible]....6
Invertebrate Zoology (Biol. 1)...5	Geology (Geol. 1).....2
General and Des. Physics (Phys. 1a).....3	General Forestry (For. 2).....3
	Physics (1a).....3
Crop Production (Agron. 1).....3	Field Crops (Agron. 2).....3
Drill.....1	Drill.....1
21	20

JUNIOR YEAR.

Expository Composition (Eng. 2).2	
Soil Physics (Agron. 3).....5	Expository Composition (Eng. 2).2
Plane Surveying (C. E. 1).....3	Soil Fertility (Agron. 4).....5
Field Practice (C. E. 1).....2	Agr. Mechanics (C. E. 7).....3
Judging of Livestock (An. Ind. 3).1	Plant Pathology (Biol. 11).....4
Bacteriology (Biol. 12).....4	Feeding Livestock (An. Ind. 4)..4
Elective.....3	History of Agriculture (Agron. 5).2
20	20

SENIOR YEAR.

Farm Management (Agron. 6)...3	
Improvement of Field Crops (Agron. 7).....4	Field Experimentation (Agron 8).3
Irrigation and Drainage (C. E. 10).....2	Economic Entomology (Biol. 5)..4
	Farm Sanitation (Vet Sci. 5)....3
Economics (3).....2	Economics (3).....2
Thesis (Agron. 9).....2	Thesis (Agron. 9).....2
Elective.....6	Elective.....5
19	19

Course in Animal Industry.

The course in animal industry consists of study in judging, feeding, breeding and caring for farm animals. Among the positions it prepares for are: Agricultural college and experiment station work, federal government work, farmers' institute work, positions as buyers and salesmen of livestock, teachers of animal industry in high schools, and managers of livestock farms. The demand for men trained in the science and practice of animal industry is in excess of the supply.

The first two years of the course are given largely to a study of basic subjects, as English, modern language, mathematics, physics, chemistry, botany and mineralogy. The last two years are given to special practical and theoretical work in judging and feeding livestock, veterinary science, bacteriology and other allied subjects.

This course is given through text books, lectures, practice, and observation. Lectures are given by specialists and the student is made familiar with the most modern ideas and acquainted with the methods of the most successful breeders and feeders in this and European countries. The work in judging is given by the use of college animals and stereopticon lectures. To secure a variety of animals, excursions are made to stock farms near the college. Advantage is also taken of the live stock on exhibition at the state and local fairs. Practical instruction is also given in compounding rations, making out pedigrees and keeping breeding records. The practical and theoretical are carefully blended.

COURSE IN ANIMAL INDUSTRY.

SOPHOMORE.

English Composition (Eng. 1)	2	Eng. Composition (Eng. 1)	2
Org. Chemistry (Chem. 5)	3	Agr. Chemistry (Chem. 7)	6
Qual. Analysis (Chem. 2)	4	Vert. Zoology (Biol. 2)	4
Invert. Zoology (Biol. 1)	5	Geology	2
Physics (Phys. 1a)	3	Field Crops (Agron. 2)	3
Crop Production (Agron. 1)	3	Physics (1a)	3
Drill	1	Drill	1
	21		21

JUNIOR.

		Judging Livestock (An. Ind. 3)	1
Judging Livestock (An. Ind. 3)	1	Feeding Livestock (An. Ind. 4)	4
Breeds of Livestock (An. Ind. 2)	5	Anatomy (Vet. Sci. 1)	3
Poultry (An. Ind. 10)	3	Soil Fertility (Agron. 4)	5
Milk and Milk Testing (Dairy 2)	4	Animal Phys. and Histology (Biol. 3)	4
Bacteriology (Biol. 12)	4	Agr'l Mechanics (C. E. 7)	3
Expository Comp. (Eng. 2)	2		
	19		20

SENIOR.

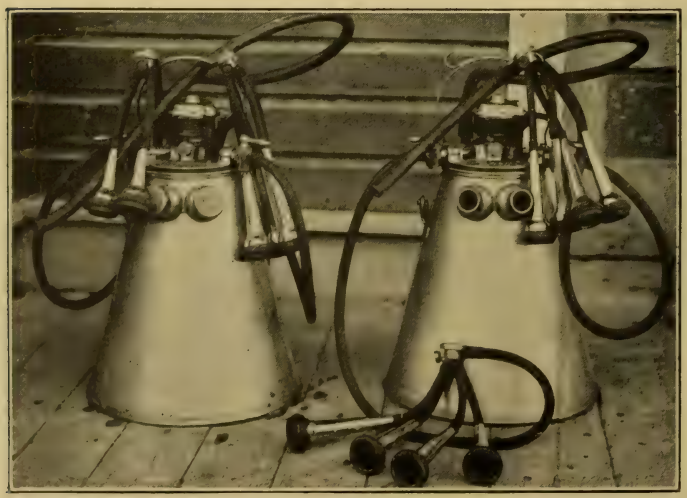
		Advanced Stock Judging (An. Ind. 7)	2
Principles of Breeding (An. Ind. 5)	3	Methods of Livestock Experimentation (An. Ind. 9)	2
Herd Books and Pedigrees (An. Ind. 6)	1	Care and Management of Livestock (An. Ind. 8)	3
Farm Management (Agron. 6)	3	Obstetrics (Vet. Sci. 7)	3
Pathology (Vet. Sci. 3)	3	Farm Sanitation (Vet. Sci. 5)	3
Thesis (An. Ind. 11)	2	Thesis (An. Ind. 11)	2
Seminar	1	Seminar	1
Elective	6	Elective	3
	19		19

Course in Dairying.

The college course in dairying covers a period of four years and offers a thorough training in this particular branch of agricultural work.

The chief object of the course is to turn out scientifically trained men to fill positions in the numerous fields that are open along dairy lines. The college has calls for men to act as assistants and professors at various agricultural colleges and experiment stations; to fill positions as inspectors of creameries and dairies in the development of the state's dairy resources; to accept positions in the U. S. Civil Service as experts and specialists in the various branches of dairy husbandry; for managers of dairy corporations, and community milk depots; to become managers of large dairy farms, and also to turn out men with a scientific, as well as a practical knowledge, with which to operate their own farms in Montana.

It is the intention to give not only the scientific side of a dairy education but also actual work in the college creamery and cheese factory.



COURSE IN DAIRYING.

SOPHOMORE.

Eng. Composition (Eng. 1)	2	Eng. Composition (Eng. 1)	2
Organic Chemistry (Chem. 5)	3	Agr. Chemistry (Chem. 7)	6
Qual. Analysis (Chem. 2)	4	Field Crops (Agron. 2)	3
Invertebrate Zool. (Biol. 1)	5	Vertebrate Zool. (Biol. 2)	4
Physics (Phys. 1a)	3	Physics (Phys. 1a)	3
Crop Rotation (Agron. 1)	3	Geology (1)	2
Drill	1	Drill	1
	21		21

JUNIOR.

Milk and Milk Testing (Dairy 2)	4	Advanced Butter Making (Dairy 3)	3
Judging Stock (An. Ind. 3)	1	Judging Livestock (An. Ind. 3)	1
Breeds of Livestock (An. Ind. 2)	5	Feeding Livestock (An. Ind. 4)	4
Poultry (An. Ind. 10)	3	Phys. and Hist. (Biol. 3)	4
Bacteriology (Biol. 12)	4	Anatomy (Vet. Sci. 1)	3
Expository Comp. (Eng. 2)	2	Soil Fertility (Agron. 4)	5
	19		20

SENIOR.

Dairy Bacteriology (Dairy 4)	4	Factory Management (Dairy 7)	3
Scoring Butter and Cheese (Dairy 6)	1	Cheese Making (Dairy 5)	2
Prin. of Breeding (An. Ind. 5)	3	Care and Management of Livestock (An. Ind. 8)	3
Pathology (Vet. Sci. 3)	3	Obstetrics (Vet. Sci. 7)	3
Farm Management (Agron. 6)	3	Farm Sanitation (Vet. Sci. 5)	3
Thesis (Dairy 8)	2	Thesis (Dairy 8)	2
Elective	3	Elective	3
	19		19

Horticulture and Forestry.

The four years' course in horticulture, leading to the degree of Bachelor of Scientific Agriculture in horticulture, is designed to prepare students as teachers in agricultural colleges, investigators in the agricultural experiment stations, editors of horticultural papers, managers of fruit associations, and superintendents of commercial orchards and fruit plantations. The West leads the world in methods of orcharding and disposing of orchard products, and there is a strong and growing demand for persons properly trained to manage the orchard projects now operated throughout the fruit regions of the West. Fruit growing, when done in a scientific way, is extemely profitable and presents an inviting field for the trained horticulturist. The college offers good facilities for a thorough training in all branches of horticulture.

A four years' course in forestry, leading to the degree of Bachelor of Science in forestry, offers instruction in the art and science of forestry and provides facilities for the education of students who desire to enter the United States Forest Service or to those who intend to become managers of large forest areas, or teachers of forestry in colleges and universities. The very extensive area of the western states now within National Forests and the still larger area of timber lands owned by individuals and companies will require the services of a large number of men who are trained along the lines of scientific forestry. The college is situated within a few miles of a large National Forest, where forest conditions can be studied at first hand. Within this National Forest are several saw mills, and an extensive area is being lumbered under the direction of the United States Forest Service. Excellent facilities for studying the methods of conservative lumbering are thus offered students of forestry.

The courses in technical forestry will be given in co-operation with the U. S. Forest Service. A scientific forester located on the Gallatin National Forest, with headquarters at Bozeman, will give the lectures and conduct investigation work in technical forestry subjects.

This arrangement offers the very best facilities for forestry students, as they are brought in direct contact with the men who are doing the forestry work in this country.

HORTICULTURE AND FORESTRY COURSE.

FRESHMAN YEAR.

French or German	4	French or German	4
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
General Botany (Biol. 9)	5	Plant Phys. and Histology (Biol. 10)	4
Trig. and Logarithms (Math. 2)	3	Prin. of Horticulture (Hort. 1)	3
**Farm Dairying (Dairy 1)	3	Animal Types (An. Ind. 1)	3
*Forest Policy (For. 1)	3	Military Drill	1
Military Drill	1		
	20		19

SOPHOMORE YEAR.

English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Qualitative Analysis (Chem. 2)	4	Agr. Chemistry (Chem. 7)	6
Organic Chemistry (Chem. 5)	3	Geology (Geol. 1)	2
Physics (Phys. 1a)	3	Physics (Phys. 1a)	3
Invertebrate Zoology (Biol. 1)	5	General Forestry (For. 2)	3
Nursery Practice (Hort. 3)	3	Field Crops (Agron. 2)	3
Military Drill	1	Military Drill	1
	21		20

*, ** See notes on page 32.

HORTICULTURE AND FORESTRY COURSE.

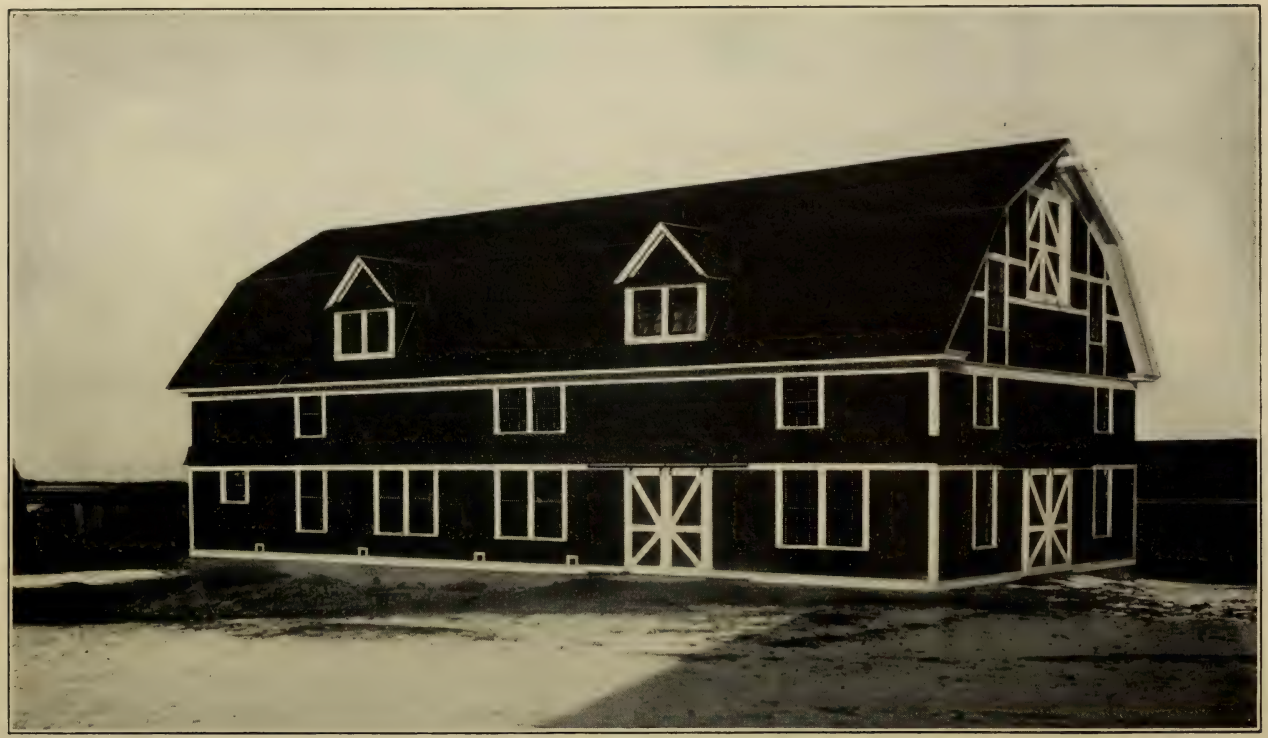
JUNIOR YEAR.

Soil Physics (Agron. 3)	5	Soil Fertility (Agron. 4)	5
Plane Surveying (C. E. 1)	3	Economic Entomology (Biol. 5)	4
Field Practice (C. E. 1a)	2	Plant Pathology (Biol. 11)	4
Bacteriology (Biol. 12)	4	**Vegetable Gardening (Hort. 4)	3
**Pomology (Hort. 2)	3	**Small Fruit Culture (Hort. 10)	2
**Expository Comp. (Eng. 2)	2	**Expository Comp. (Eng. 2)	2
*Silviculture (For. 3)	3	*Forest Protection (For. 4)	3
*Forest Botany (Biol. 13)	3	*Forest Laws (For. 6)	2
		*Elective	2
	19 or 20		20

SENIOR YEAR.

Economics	2		
Elementary Drawing (C. E. 29)	3		
**Evolution of Cultivated Plants (Hort. 5)	3	Economics	2
**Commercial Fruit Growing (Hort. 9)	2	**Landscape Horticulture (Hort. 8)	3
		**Greenhouse Construction and Management (Hort. 6)	3
**Irrigation and Drainage (C. E. 10)	2	**Plant Breeding (Hort. 7)	4
*Forest Technology (Biol. 14)	3	*Forest Economics (For. 9)	4
*Forest Mensuration (For. 7)	3	*Forest Mensuration (For. 7)	3
*Lumbering (For. 8)	4	*Lumbering (For. 8)	3
Thesis	2	Thesis	2
Elective	3 or 5	Elective	5
	19		19

Note: Subjects not marked with asterisk common to both courses.
Subjects marked with * required of forestry students.
Subjects marked with ** required of horticulture students.



HORSE BARN.



CATTLE BARN.

Agronomy

PROF. ATKINSON.

On the main floor of the new agricultural building, modern and thoroughly equipped soil and grain laboratories and class rooms have been fitted up.

The soil laboratory accommodating forty-eight students, provides for accurate work in soil physics and soil fertility. Upwards of two thousand dollars have beeen expended in equipping these laboratories with the most up-to-date fittings and apparatus, in order that the students may enjoy the very best facilities.

In the grain laboratory specially designed individual judging tables have been installed. This permits each students to pursue careful and continuous work in grain judging and enables him to become thoroughly familiar with the various grain standards. Vermin proof storage cases for class materials and standard samples have been provided. These insure the preservation of valuable material as accumulated. Score cards based on Montana conditions, have been prepared for wheat, oats, barley and corn, and are used to impress students with the points to be looked for in grain judging work.

A portion of the space in the new greenhouses is given over to pot culture and germination work. Plots on the college farm are available for student work.



Students Studying Soils

(1) **Crop Production.**—Reproduction, germination and growth. Vitality and germination of seeds with circumstances influencing these; conditions of plant growth, peculiarities of the different agricultural plants in respect to structure, habits and requirements for successful growth. I, 3.

(2) **Field Crops.**—A study of the farm, grain crops, forage crops, root crops, sugar and fiber crops; their history and distribution, consumption of products and residues or by-products. In this course considerable time is spent in score card practice in the grain judging laboratory. II, 3.

(3) **Soil Physics**—This course is designed to prepare the students to understand better the effects of the different methods of treating soils, and the influence of these upon moisture, texture, aeration, fertility, and production. It comprises a review of the origin, formation and classification of soils and a study of the conditions influencing the supply of heat, air and moisture as related to growing plants. The work of the class room is supplemented by laboratory work comprising the determination of such questions as the water holding capacity and capillary power of various soils; the effect of mulches and of various systems of rotations on the physical condition of the soil. Two lectures and three laboratories. I, 5.

(4) **Soil Fertility**—Maintenance of fertility, fertilizers and rotation. The influence of barn yard manure, green manuring and commercial fertilizers upon the quality and yield of the various crops. The effects of different crops upon the fertility of the soil and upon succeeding crops; different rotations and the ultimate effect of different methods of farm management upon the fertility and productive capacity of the soil; also a study of the preservation of barn yard manure. Included in this course is a laboratory study of the effect of different rotations and soil management systems upon the plant food content of the soil. Pot culture work to show relation between added fertilizers and crop produced is also carried on. Three lectures and two laboratories. II, 5.

(5) **History of Agriculture.**—A study of the development of agriculture from the dawn of civilization, considering farming as carried on by the Greeks and Romans; through the middle ages; feudal farming and the dawn of modern methods and practices in agriculture. II, 2.

(6) **Farm Management.**—This course considers the problems of farm management; the relative profits of different systems of farm management, the relation of the industry of agriculture to other industries, and the social conditions of agriculture are considered. I, 3.

(7) **Improvement of Field Crops.**—In this course are considered the different plant improvement theories, and methods used where marked improvement has been effected. Also a discussion of the lines of possible improvement in field crops. I, 4.

(8) **Field Experimentation.**—This course comprises a study of the methods of presenting the results of field experiments; also a study of the plans and methods used in crop experimentation, with methods for keeping records. II, 3.

(9) **Thesis.**—Agronomy students are required to prepare a graduating thesis on some subject to be approved by the head of the agronomy

department. The subject of this thesis must be decided on not later than November 15th, of the senior year, and must include considerable research and experimental work on the part of the student. I and II, 2.

Animal Industry

PROF. CLARK.

For the work in animal industry there is available a herd of twenty-five dairy cows, small herds of pure bred cattle, Herefords, Shorthorns, Angus, Holsteins and Jerseys, Percheron and the farm horses, some pure bred hogs, Berkshire, Poland China and Yorkshire. During the winter season the live stock used in the feeding experiments is also available for study. For the poultry work eight breeds of fowls are kept.

The cattle barn is a two-story frame building with two wings extending to the south. One of these wings is used for the dairy cows and breeding stock, and the other for bulls, young stock and calves. Between these two rooms is located a stock judging room forty feet square. The second story of the main barn is used for the storage of hay. The first story provides feeding rooms, storage for grain, and box stalls.

The new horse barn is a two story frame building with stalls for 20 horses, carriage and feed rooms, and capacity of 100 tons of hay.

The piggery consists of a main building thirty by thirty-five feet, with two wings sixteen by fifty feet each. In the main building are the feeding rooms and slaughter room, while the wings provide six pens each.

The poultry buildings include two main buildings, one seventy-two by sixteen feet, with twelve pens; the other one hundred and twenty-eight feet long, with eight pens; with yards one hundred feet long on either side, and a brooder house, thirty-six by sixteen feet. These buildings are connected by a feed room, fourteen by twenty feet, under which is an incubator cellar and a heating plant for the building. They are south of the experiment station building.

The Tenth Legislative Assembly made an appropriation of $5,000 for the purchase of live stock for the college. This has been used to enlarge the herds of pure bred cattle and to secure horses and a small flock each of a few of the best sheep for Montana.

(1) **Animal Types**—A study of type as related to production and work. This course covers the judging of the different market classes of cattle, (beef and dairy), of sheep, (mutton and wool), of horses, (light and heavy), and of hogs, (bacon and fat). One half of the time of this course is given to practical handling and judging of the stock in the stock pavilion. I, 3.

(2) **Breeds of Live Stock.**—A study of the development of the breeds of horses, cattle, hogs and sheep will illustrate the principles and particular characteristics and distinguish one breed from another and will

show the adaptability of each particular breed to various climates, conditions and purposes. These lectures will be illustrated by stereopticon views of characteristic animals of the different breeds. Lecture 2. Lab. 1, II, 3.

(3) **Judging Live Stock.**—This is a critical study of the different breeds of live stock from a study of living animals. One afternoon a week in stock judging pavilion for the year. I and II, 2.

(4) **Feeding Live Stock.**—The principles underlying the profitable feeding of animals. The composition of plants, animals and animal products. The practice that gives best results as indicated by available data gathered from the work of experiment stations in this and other countries. II, 4.

(5) **Principles of Breeding**—A study of the laws of heredity, of correlation, reversion, variation, selection and methods of grading, crossing, in- and in-breeding, etc. Application of these laws is illustrated by reference to the practices of noted improvers of animals and plants. The students are shown how these laws may be taken advantage of in improving the live stock of the farm. I, 3.

(6) **Herd Books and Pedigrees.**—This is largely a laboratory study of the herd books of different breeds of live stock. The tabulation of pedigrees and such other exercises as will enable the student to learn the value of a pedigree and show how to keep the record of a breeding herd. II, 1.

(7) **Advanced Stock Judging.**—Animal measurements and the systematic study of animal form, function and performance; the aim being to give exact and intimate acquaintance with the detailed form of specialized types, a knowledge that is essential to the highest success in selection and breeding; also some systematic work in the judging of groups of cattle, horses, sheep and swine, similar to those found at county and state fairs. II, 2.

(8) **Care and Management of Live Stock.**—A special study of the methods to be followed in the breeding, feeding and development of the various classes of live stock as illustrated from the practices of the most successful live stock breeders. II, 3.

(9) **Methods of Live Stock Experimentation.**—This is a study of experiment station literature along the lines of live stock experiments to enable the student to get acquainted with the methods pursued in those investigations. II, 2.

(10) **Poultry**—Breeds and management; poultry houses; feeding and care of poultry; the operation of incubators and brooders. I, 2.

(11) Students specializing in animal industry will be required to prepare a thesis during their senior year based upon some line of original work, to be arranged with the head of the department I, II, 2.

Veterinary Science

(1) **Anatomy.**—Lectures describing the locomotory apparatus, including bones, articulation, and muscles; also careful description of the viscera, blood vessels, nerves and organs of special sense. The horse will be taken as a type. Laboratory dissection. II, 3.

(2) **Comparative Anatomy and Physiology.**—A more advanced and thorough consideration of the anatomical construction with special reference to the comparative anatomy and physiology of the horse, ox, sheep and hogs. Laboratory dissection. I, 3.

(3) **Pathology.**—General pathology, consisting of a brief course in morbid anatomy and histology. Laboratory clinic. I, 3.

(4) **Materia Medica.**—This work will include a consideration of the common remedies used in the treatment of diseases. A few lectures on toxicology and serum therapeutics. Laboratory tuberculin testing, mallein testing, vaccination and immunization. II, 3.

(5) **Farm Sanitation.**—A comprehensive course in general sanitation relating to sources of water, milk and food supplies, sewerage disposal, source and spread of infectious diseases both of man and animals; the prevention and inhibition of infection, decomposition and decay. A study of asepsis, antiseptics, disinfection and disinfectants. II, 3.

(6) **Common Diseases of Farm Animals.**—Etiology, prophylaxis, diagnosis, treatment and eradication. This course will also include a few lectures on government control and supervision of diseases of livestock. II, 2.

(7) **Obstetrics.**—Diseases of animals incident to reproduction. The nursing and care of animals during this period, proper shelter with suggestions as to home treatment.

Dairying

PROF. ELLIOTT.

In this department we are thoroughly equipped with all modern appliances for the manufacture of butter and cheese. We have 8 different makes of hand separators, so that the student has an excellent opportunity to compare the merits and demerits of each. In churns we have the Simplex and Disbrow, both combined churns and butter workers, yet entirely different in style. In addition there is a model milk room, twin cream ripening vats, tempering vats, starter cans and a Hohn refrigerator, together with all things necessary for the manufacture of butter as it is done in an up-to-date plant.

The creamery is equipped with a 12-horse boiler and 10-horse high speed engine, and in the practical work the students take their turn in the engine room, for the practical experience gained thereby.

One end of the dairy building is used as a cheese room; in this we have cheese vats, gang and upright presses, and all necessary hoops and equipment for the manufacture of all varieties of American Cheddar cheese. In this department we make both Edam and Brick cheese, but especial emphasis is placed on the manufacture of the American cheese.

The testing laboratory is very thoroughly equipped with four different styles of Babcock testers (both hand and steam) and all necessary glassware for the testing of milk, cream, butter, cheese, skim milk, whey, etc. Especial emphasis is laid upon the testing of milk and its products for adulterations.

(1). **Farm Dairying.**—This course will consist of two lectures and one laboratory period, and will comprise a study of the subject of dairying in its general relation to the farm. The class work takes up production of milk, separation of cream by gravity and separator; the preparation of starters; the ripening and churning of cream; the packing and marketing of butter. The use of the Babcock tester is also discussed with articular reference to its use on the farm; also the construction of the milk house and stables, with regard to sanitary conditions as well as to utility. I, 3.

(2) **Milk and Milk Testing.**—This course will comprise a study of milk, its secretion, composition, and uses; pasteurization; separation and handling for city milk trade; the care of milk for creamery or cheese factory; also the testing of variations and adulterations; the testing of butter and cheese; and the use of the acidimeter. Two lectures and two laboratory periods. I, 4.

(3) **Advanced Butter Making.**—This comprises a thorough and detailed study of the physical and chemical properties of milk and its components; of the principles of separation of cream by gravity and centrifugal separators, the effect of the different degrees of acidity of cream upon the quality of butter, and the principles of churning, packing and marketing of butter. The laboratory periods are devoted to practical work in the creamery, where the student has an opportunity to study all the leading makes of separators and churns, etc. This course gives the student an intimate knowledge of actual creamery conditions. Two lectures and one laboratory. II, 3.

(4) **Dairy Bacteriology.**—This course will comprise a study of the relation of bacterial life to milk and milk products. The question of bacterial infection of milk and methods of prevention; fermentations in milk and their treatment. Disease producing bacteria in milk, preservation of milk with especial reference to pasteurization. The bacteria in fluid products of milk, butter and cheese. Three lectures and one laboratory. I, 4.

(5) **Cheese Making.**—The equipment for factory and home cheese-making, the principles and practice necessary to make a uniform article and methods used to overcome characteristic differences are explained and

illustrated in the class room and laboratory. All common varieties of cheese, such as Cheddar, Swiss, Brick, Limburger, are discussed, and as far as possible made in the class room, but the Cheddar cheese making is particularly emphasized. II, 2.

(6) **Scoring Butter and Cheese.**—This course is designed to give the student a correct idea of the standard market requirements for dairy products. Butter and cheese are examined and scored by the student and their judgment compared with the instructor's. One laboratory. I, 1.

(7) **Factory Management.**—The location, organization, construction, arrangement, apparatus, the equipment and operation of farmer's co-operative or private enterprise creameries or cheese factories. Methods of paying for milk and cream, and the preparation of plans for home dairy or co-operative factory. II, 3.

(8) **Thesis.**—During the senior year all dairy students are required to prepare a thesis. This must be original work by the student, who should consult with the professor in charge regarding a subject. Two credits will be allowed in the first semester and two in the second for this work. If it is sufficiently meritorious, such thesis may be published.

Horticulture and Forestry

PROF. FISHER.

Among the facilities offered for instructional purposes and practical demonstration in the courses in horticulture and forestry may be mentioned: The orchard containing about 500 trees of hardy varieties of apples, pears, plums and cherries; the small fruit garden containing all the commercial varieties of bush fruits and strawberries; the vegetable garden in which are grown each year different varieties and kinds of vegetables; the nursery containing varieties of fruit trees and shrubs, and a large list of ornamental and forest trees, many plants being propagated in the nursery for the college campus; seed beds in which are grown forest tree seedlings and ornamental plants; hot beds and cold frames used in plant propagation and culture; two greenhouses, each 20x40 feet, used for instructional purposes in greenhouse management, plant propagation and manipulation, and plant breeding; a collection of horticultural implements for budding, grafting, pruning, etc.; models of apples showing the varieties adapted to Montana and the fungus diseases to which apples are subject; a collection of preserved and natural specimens of fruits and woods; pictures and lantern slides showing different kinds of orchards, and forest conditions; lantern slides showing the structure of different woods; apparatus for measuring trees in the forest, and scaling logs.

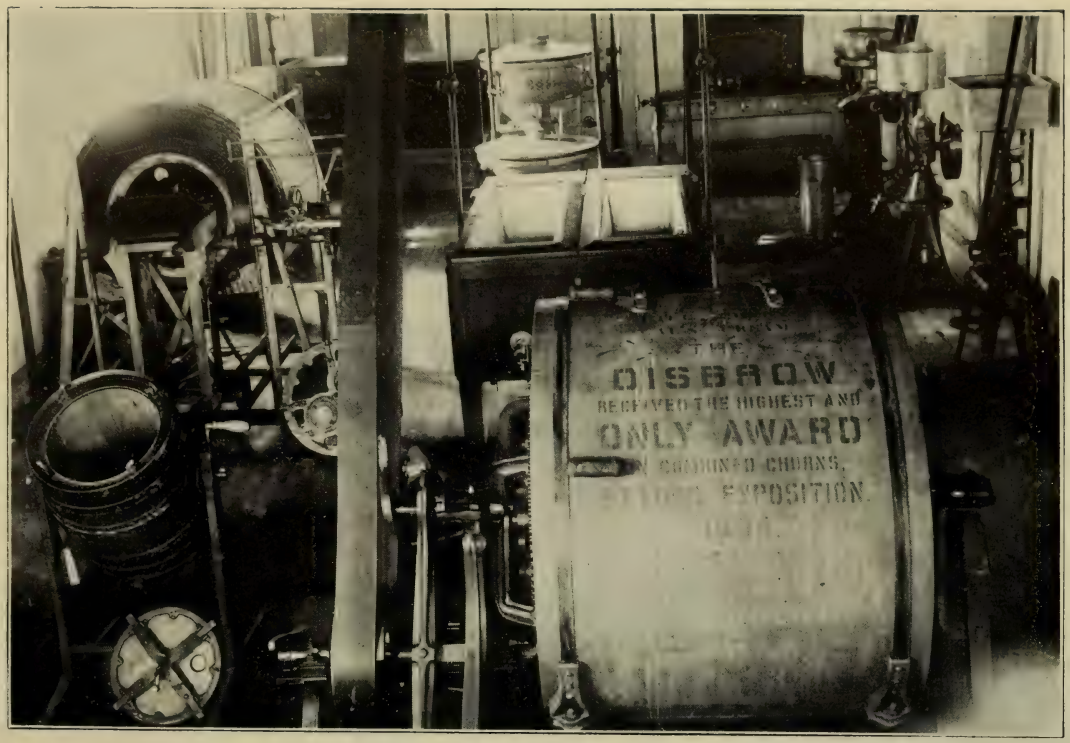
The library contains many standard works upon horticulture and forestry.



Horticulture Class



IN THE GREEN HOUSE.



IN THE DAIRY.

Horticulture

(1) **Principles of Horticulture.**—This course will deal with the principles underlying the various horticultural operations; variation, selection and crossing of plants with reference to plant improvement. The methods of pruning, cultivation, gathering and marketing of fruits and vegetables are studied along with the principles in each case: II, 3.

(2) **Pomology.**—This course deals with the principles and methods of fruit growing. The methods of propagating fruit trees and shrubs, pruning, cultivating and the general management of fruit plantations are considered. A systematic study of all northwestern fruits is made. I, 3.

(3) **Nursery Practice.**—The methods of collecting, storing and planting tree seeds; growing and caring for seedlings in the seed bed; transplanting and caring for the seedlings in the nursery row; methods of transplanting to permanent places; growing trees from cuttings, layers, sprouts, grafts, buds, etc. This subject is taught by lectures, text books and field work. I. 3.

(4) **Principles of Vegetable Gardening.**—Lectures and practice; treating of the principles and methods of growing vegetables under glass and in the field, particular attention being given to the vegetables suited to Montana conditions. II, 3.

(5) **Evolution of Cultivated Plants.**—Lectures and text book work on evolution relating to the cultivated horticultural plants. I. 3.

(6) **Green House Construction and Management.**—The construction, heating and maintaining of greenhouses, with lectures and practice treating of the methods of growing plants in greenhouses and conservatories. I, 3.

(7) **Plant Breeding.**—Lectures, text books and practice. This subject deals with the principles and methods of improving plants by cross-pollenating, selection, etc. II, 4.

(8) **Landscape Horticulture.**—The laying out and planting of private and public grounds are discussed. The trees, shrubs and flowers suited to Montana conditions are studied. II, 3.

(9) **Commercial Fruit Growing.**—In this course the methods of planting, cultivating, irrigating and managing commercial orchards are discussed in the class room and orchard. The methods of picking, grading, packing and marketing fruits are important phases of the course. Lectures and laboratory. I, 2.

(10) **Small Fruit Culture.**—A study of the methods and principles underlying the culture of bush fruits; their classification and origin. Laboratory and lecture. II, 3.

(11) **Thesis**—Two credits throughout the senior year will be given for a thesis based upon original research along some horticultural line.

Forestry

(1) **Forestry Policy.**—Lectures and text book work pertaining to the policy of the United States government in regard to public forests; the growth and importance of the forest movement in the United States; the policy of the States in regard to State forests, etc. I, 2.

(2) **General Forestry.**—Treating of forest influences on climate, flow of streams, winds, etc. This course is required of all agricultural students, and sophomores in the forestry course. II, 3.

(3) **Silviculture.**—The principles underlying the growth of trees in groups, or in the forest, methods of reproduction; discussion of the different silvicultural systems of management, and the application of each to a given tract and under various forest conditions. I, 3.

(4) **Forest Protection.**—A discussion and study of the methods employed in protecting forests against damage from fire, grazing, careless lumbering, etc. II, 3 .

(6) **Forest Laws.**—The laws governing the federal forest reserves; the rules and regulations adopted by the forest service; and the several state laws governing state forests. II, 2.

(7) **Forest Measurement.**—This subject deals with the determination of the contents of logs, the construction of log rules, methods of scaling logs, estimating and cruising timber, the determination of yield, etc. Lectures, textbooks and extensive field practice. I, II, 6.

(8) **Lumbering.**—A history of the growth and importance of the lumber industry in the United States; the methods of lumbering in different sections of the country; the uses of the various kinds of trees; the methods and machinery employed in saw mills in manufacturing saw logs into lumber; methods of lumbering as applied to different parts of the country and with different woods, in order to protect young growth and induce reproduction. This study will require the students to make a working plan of a given tract which is to be lumbered. In order to make the plan the tract will have to be cruised, the different kinds and grades of lumber estimated, the methods to be employed in cutting and logging to save young growth must be determined, logging roads to the mill must be laid out and constructed, the management and location of logging camps must be planned, etc. This course will be given by lectures, text books, required reading and very extensive field work in the forests near Bozeman. I. II. 7.

(9) **Forest Economics.**—This course deals with the position the community and government should take with reference to their forest resources; the business aspects and conduct of forest lands; the relation of the lumber industry to the welfare of the nation, etc. II, 4.

(10) **Thesis.**—Four credits in the senior year are given for work upon a thesis based upon original study in forestry. I, II, 4.

Division of Engineering

The purpose of the course offered in the division of engineering is to furnish the student the fundamental training essential to a successful engineer; this result is accomplished, not alone by the study of the theoretical, but by giving attention to the practical application of the principles involved. A limited degree of flexibility is given in some of the courses through electives, thus enabling the student to specialize in any chosen study.

Candidates for engineering courses must be graduates from accredited high schools, the college preparatory department, or pass equivalent examinations.

Courses are offered in civil engineering, electrical engineering or mechanical engineering leading respectively to the degrees of Bachelor of Science in civil, electrical or mechanical, engineering. On the completion of one year of post graduate work, or three years of professional work and the presentation of an acceptable thesis, the college will confer upon the holders of bachelors' degrees in these courses the degrees respectively of Civil Engineer, Electrical Engineer, or Mechanical Engineer.

Civil Engineering

This course is designed to give to the student all of the fundamental studies necessary for the profession and at the same time speecially qualify him to meet best the particular classes of engineering work most likely to be required in Montana.

Without overlooking the importance of a thorough knowledge of the fundamental principles of engineering, the course has been designed to overcome partially some of the difficulties encountered by the young engineer in entering the work of practical life. We hope to meet in a small way the lack of understanding of practical rules and methods, for which so many of our college graduates are criticized by the general public and which so handicaps the student upon graduation. Not only is the student taught with the idea of making him an efficient office assistant, but a little insight is given into the practical; he makes estimates of cost of construction and such items as will enable him to appreciate the value and necessity of business and engineering methods, and possibly lead the way to engineering management and contracting.

Special care has been given to perfect the student, as far as possible, in the branches of engineering work which promise the best in the future of this state; namely, road and railway engineering; sanitary engineering; irrigation engineering; hydraulics and water power development.

In order to enable the student to specialize, and to avoid the use of electives, the course has been divided, after the sophomore year, into two branches, both of which lead to the degree of B. S. in civil engineering. One course enables the student to become especially proficient in irrigation engineering and the use of instruments; while the other specializes in those studies essential to the sanitary engineer. Both courses are equally strong in railway and structural work.

As far as possible, the student taking this course will be expected to engage in practical engineering work during the summer vacations, and to this end each student registering in the course will be assisted in securing such positions as he may be able to fill at the close of each year. Thus far the demand for such student assistance has exceeded the supply.

The equipment of the department is up-to-date and sufficiently large to meet all present requirements.

CIVIL ENGINEERING

FRESHMAN YEAR

First Semester		Second Semester	
Algebra, (Math. 1)	3	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Descriptive Geometry (M. E. 3)	2
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (1)	1	Public Speaking (1)	1
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
Elementary Drawing (E.E. 29)	3	Mechanical Drawing (M. E. 3a)	3
Freehand Drawing (Art 3)	2	Freehand Drawing (Art 3)	2
Military Drill	1	Military Drill	1

SOPHOMORE YEAR.

Calculus (Math. 4)	5	Calculus (Math. 4)	5
Expository Composition (Eng. 2)	2	Electrical Machinery (E. E. 1)	1
General Physics (Physics 1)	3	Cement Tests (C. E. 15)	1
Plane Surveying (C. E. 1)	3	General Physics (Physics 1)	3
Field Practice (C. E. 1a)	2	Physical Measurements (Physics 2)	2
Roads and Pavements (C. E. 2)	1	Railway Engineering (C. E. 4)	4
Physical Measurements (Phys. 2)	2	Field Work and Plotting (C.E. 4a)	2
Military Drill	1	Military Drill	1

JUNIOR YEAR.

Theoretical Mechanics (C.E. 5)	4	Applied Mechanics (C. E. 6)	4
Hydraulics (C. E. 8)	3	Strength of Materials (M. E. 14)	1
*Irrigation Engineering (C.E. 9)	2	Roofs and Bridges (C. E. 13)	2
*Field Practice (C. E. 11)	3	Engineering Design (C. E. 13a)	4
Seminar (C. E. 12)	1	Sanitary Eng. (C. E. 14)	2
*Least Squares (Math. 5)	2	Reservoirs and Dams (C. E. 16)	1
Graphic Statics (C. E. 30)	2	Seminar (C. E. 12)	1
*Cost of Construction (C.E. 25)	2	*Light and Sound (Physics 3)	2
**Biology (Biology 9)	5	*Geology	2
**Qualitative Analysis (Chem 2)	4	**Quantitative Analysis (Chem. 3)	4

SENIOR YEAR.

*Geodetric Surveying (C.E. 17)	2		
Economics (3)	2	Hydrographic Surveying (C. E. 22)	1
Water Power Development (C.E. 18)	3	Economics (3)	2
Engineering Design (C. E. 19)	3	Contracts and Specifications (C. E. 23)	3
*Field Practice (C.E. 20)	2	Municipal Engineering (C. E. 3)	2
Foundations and Masonry (C. E. 21)	3	Engineering Design (C. E. 19)	3
Seminar (C. E. 12)	1	*Practical Astronomy (C. E. 24)	2
*Astronomy (Math. 6)	3	Seminar (C. E. 12)	1
**General Bacteriology (Biol. 12)	4	**Water and Air Analysis (Chem. 10)	2
**Organic Chemistry (Chem 5)	3		
Thesis (C. E. 27)		Thesis (C. E. 27)	5

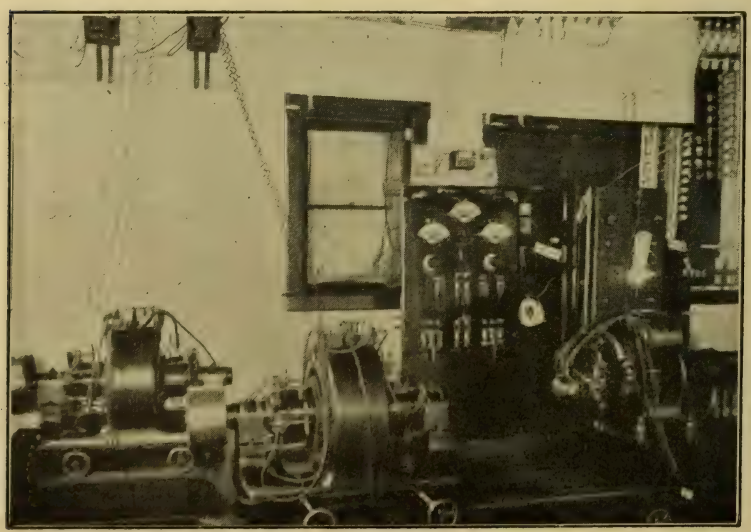
NOTE:—Studies marked * are included in the regular course only.
Studies marked ** are for the sanitary engineering course only.
Unmarked studies are common to both courses.

Electrical Engineering

This course provides a thorough technical training in electrical engineering. The rapid development of electrical engineering is largely due to the use of sound theory in the solution of commercial problems. For this reason the theoretical subjects, and the application of theory to the solution of practical problems are emphasized.

The course is designed to teach students the scientific laws and principles forming the basis of the profession, and the application of these laws and principles to commercial problems. The general training consists of courses in mathematics, physics, chemistry, drawing and shop work. The electro-technical work consists of lectures and recitations on the theory of electrical phenomena, and of problems in the design, construction and operation of electrical machines and apparatus. Conventional methods are used in drawing and designing, and the experimental tests made in the laboratory are essentially similar to the tests made by large manufacturing companies. The apparatus and instruments used are of modern commercial types.

The course is supplemented by an annual inspection trip to some of the large power plants of Montana, and by lectures from prominent electrical engineers.



Electrical Laboratory

ELECTRICAL ENGINEERING

FRESHMAN YEAR

First Semester.		Second Semester.	
Algebra (Math. 1)	3	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Descriptive Geometry (M.E. 3)	2
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (1)	1	Public Speaking (1)	1
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
Elementary Drawing (E. E. 21)	3	Mechanical Drawing (M. E. 3a)	3
Joinery (M. E. 2)	2	Foundry and Pattern Making (M E. 4)	2
Military Drill	1	Military Drill	1
	18		19

SOPHOMORE YEAR.

Calculus (Math. 4)	5	Calculus (Math. 4)	5
Expository Composition (Eng. 2)	2	General Physics (Phys. 1)	3
General Physics (Phys. 1)	3	Physical Measurements (Phys. 2)	2
Physical Measurements (Phys. 2)	2	Electrical Machinery (E.E. 1)	2
Forge Work (M. E. 6)	2	Dynamo Drawing (E. E. 2)	2
Military Drill	1	Military Drill	1
Electives	4 or 5	Electives	3
	19 or 20		19

JUNIOR YEAR.

Theoretical Mechanics (C.E. 5)	4		
Applied Electricity (E.E. 3)	3	Applied Mechanics (C. E. 6)	4
Electricty and Mag. (Phys. 5)	2	Dynamos and Motors (E. E. 5)	4
Electrical Measurements (Phys. 6)	2	Dynamo Design (E. E. 8)	3
Electrical Diagrams (E.E. 7)	2	Strength of Material Lab. (M. E. 14)	1
Electrical Lab. (E.E. 4)	2	Dynamo Testing (E. E. 6)	2
Seminar (E.E. 17)	1	Seminar (E. E. 17)	1
Electives	3	Electives	3 or 4
	19		18 or 19

SENIOR YEAR.

		Alternating Currents (E.E. 11)	4
Alternating Currents (E.E. 9)	4	Economics (3)	2
Economics (3)	2	Alternator Design (E. E. 16)	3
Transformer Design (E.E. 13)	3	Contracts and Specifications (E. E. 14)	1
Power Plant Operation (E.E. 15)	1	Pholyphase Testing (E. E. 12)	2
Single Phase Testing (E.E. 10)	3	Seminar (E. E. 17)	1
Seminar (E.E. 17)	1	Thesis (E. E. 20)	3
Thesis (E. E. 20)	2	Electives	3
Electives	3		
	19		19

Mechanical Engineering

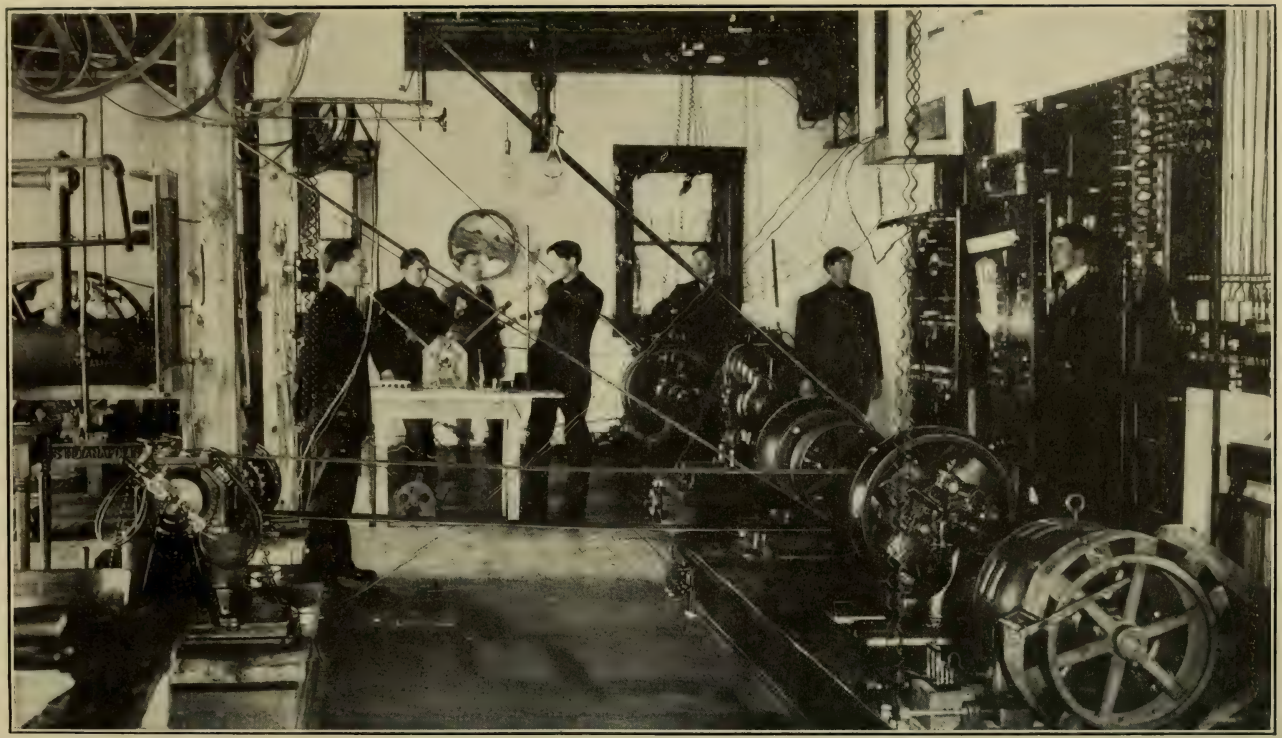
The purpose of this course is to prepare young men as fully as possible, within the limited time, for the management of manufacturing establishments, the designing, construction and erection of machinery, the superintendence of construction, and for other branches of the profession.

The course comprises four years' instruction and training by text book, lecture, laboratory and shop practice, based on the fundamental subjects, mathematics, physics, chemistry, pure and applied mechanics, machine design, structural design and thermodynamics. It is designed to give the student a thorough knowledge of the basic principles of his profession and such technical skill as the application of theoretical principles in every-day practice in shop and laboratory will insure, and so to strengthen his abilities that his future career may be the most successful of which he is capable.

It is a fundamental principle, recognized by educators that laboratory and shop work constitute a most important means of illustrating and impressing engineering principles, and with this in view the work of each department,——class room, laboratory, shop and designing room,—is made to supplement the work of each of the others, thus giving a balance in the mental equipment of the young engineer obtainable in no other way. The value of such balance to the engineer at the beginning of his career is recognized in the course offered on the opposite page.



MACHINE SHOP.



ELECTRICAL ENGINEERING LABORATORY.

MECHANICAL ENGINEERING

FRESHMAN YEAR

First Semester		Second Semester	
Algebra (Math. 1)	3	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Descriptive Geometry (M. E. 3)	2
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (Pub. Sp. 1)	1	Public Speaking (Pub. Sp. 1)	1
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
Mechanical Drawing (M. E. 1)	3	Mechanical Drawing (M.E. 3a)	3
Joinery (M. E. 2)	2	Foundry and Pattern Making (M. E. 4)	2
Military Drill	1	Military Drill	1
	18		19

SOPHOMORE YEAR.

Calculus (Math. 4)	5	Calculus (Math. 4)	5
Expository Composition (Eng. 2)	2	Steam Eng. & Boilers (M. E. 7)	2
General Physics (Phys. 1)	3	General Physics (Phys. 1)	3
Physical Meas. (Phys 2)	2	Physical Meas. (Phys. 2)	2
Kinematics (M. E. 5)	2	Kinematics (M. E. 8)	2
Mechanical Drawing (M. E. 5a)	3	Mechanical Drawing (M. E. 8a)	1
Forge Work (M. E. 6)	2	Forge Work (M. E. 9)	2
Military Drill	1	Boiler Room Practice (M. E. 16)	2
	20	Military Drill	1
			20

JUNIOR YEAR.

Theoretical Mechanics (C.E. 5)	4		
Elec. & Magnetism (Phys. 5)	2		
Elec. Measurements (Phys. 6)	2		
Indicator & Valve Gears (M.E. 15)	2	Applied Mechanics (C. E. 6)	4
Mechanical Laboratory (M.E. 15a)	1	Machine Design (M. E. 13)	3
Hydraulics (C. E. 8)	3	Strength of Materials (M. E. 14)	1
Graphic Statics (C. E. 30)	2	Dynamos & Motors (E. E. 5)	4
Mechanical Drawing (M. E. 10)	1	Dynamo Testing (E. E. 6)	2
Machine Work (M. E. 12)	2	Mechanical Drawing (M.E. 13a)	3
	19	Machine Work (M.E. 17)	2
		Seminar (M. E. 11)	1
			20

SENIOR YEAR.

		Thermodynamics (M. E. 22)	2
		Economics (3)	2
Thermodynamics (M. E. 18)	3	Engine Design (M. E. 23)	2
Economics (3)	2	Mechanical Drawing (M. E. 23a.)	2
Boiler Design (M.E. 19)	1	Roofs and Bridges (C. E. 13)	2
Mechanical Drawing (M. E. 19a)	2	Engineering Designs (C. E. 13a)	2
Mechanical Lab. (M. E. 20)	3	Contracts & Specifications (M. E. 24)	1
Machine Work (M. E. 21)	2	Shop Management (M. E. 25)	1
Seminar (M. E. 11)	1	Electives	3
Electives	3	Thesis (M.E. 26)	2
Thesis (M. E. 26)	2		
	19		19

CIVIL ENGINEERING

PROF. TANNATT

ASST. PROF. KNEALE.

MR.....

The equipment of this department consists of 4 transits, 2 with solar attachments; precision level; four engineers' levels; 3 plane tables with alidades and declinators; one sextant; artificial horizon; one reflectoscope; two engineers' aneroid barometers; one engineers' compass; clinometer; one hand level; one stadia hand level; one Burton's transit; five current meters; three automatic water registers; one Fairbanks' briquette testing machine with briquette molds, etc.; two vicat needles; one fineness scale; one set assay balances; one odometer; one specific gravity apparatus; one weir measuring device; one adjustable weir; one set of railway curves; one rolling planimeter; 2 polar planimeters; level and stadia rods; chains, tapes and pins; calculating instruments, etc.

In addition to the above the department is supplied with a good office equipment in the way of draughting instruments, scales, T squares, straight edges, etc.

The quarters of the department are in the second story of the main building and consist of two recitation rooms, one large draughting room, and the office. The draughting room is well supplied with desks and draughtboards, also a traveling blue print frame capable of printing drawings 36x52 inches. A suitable dark room and apparatus for teaching the methods of making and printing blue-process papers forms a part of the equipment.

(1) **Plane Surveying.**—The use and adjustment of ordinary surveying instruments, such as the compass, level, transit, plane table, and sextant. The theory and practice of land surveying, leveling and topography; keeping of field notes and plotting. Time, 3 hours recitation per week. (C. E. 1a) is also a part of this course. Text, Johnson's Theory and Practice in Surveying. Prerequisites, mathematics up to and including trigonometry. I, 3.

(1a) **Field Practice.**—The practical use of ordinary civil engineering instruments in field work. Practice in measurement of lines and angles with the chain, tape, stadia, and transit. Measurement of fields, volumes, angles, and the calculations derived from same. The use of the level in measuring elevations, establishing grades, measurement of volume, etc. During inclement weather the student will be required to do plotting and make calculations from field notes. This course forms a part of the course in plane surveying. Time, 5 hours per week. I, 2.

(2) **Roads and Pavements.**—A course in good road construction. Different methods of construction considered together with the best forms of

surface, cost, etc. The influence of good roads upon property values and justifiable expense necessary to secure them. Illustrated lecture course. One hour per week. Elective to all regular students of the college or preparatory courses. I. 1.

(3) **Municipal Engineering.**—This course is designed specially to qualify the engineer along the lines of highway construction, both city and county. Different surface materials, influence of grades, forms of gutters, culverts, curbing, etc., are carefully studied. This course is especially designed to meet the requirements of the municipal engineer. Prerequisites, C. E. 1, 2 and 4. Text, Baker's Roads and Pavements. II, 2.

(4) **Railroad Engineering.**—Railroad reconnoitering, preliminary and location surveys. Theory and practice in laying out railroad curves, turnout, switches, and crossings. Cost of railroad construction, timber, structures and culverts. Making and use of profiles, field maps, cross sections, etc. Calculation of yardage in embarkments and excavation. Four hours recitation per week. Prerequisites, C. E. 1 and 1a. Text, Webb's Railroad Construction. II, 4.

(4a) **Field Work and Plotting.**—Practice in railroad topography, laying out curves and tangents, cross-sections, etc. A preliminary and location survey will be made and the students required to complete all maps, profiles and estimates for same. This course forms a part of C. E. 4, Time, five hours recitation per week. No text required, but the student will be required to provide himself with necssary drawing instruments. II, 2.

(5) **Theoretical Mechanics.**—Kinematics, Newton's laws of motion, dynamics of a particle, statics, friction, work and energy, dynamics of rotation, graphical and analytical methods employed. Text, Wright's Elements of Mechanics. Time, four hours per week. Prerequisites, mathematics, including calculus, physics 1 and 2. I, 4.

(6) **Applied Mechanics.**—Resistance and elasticity of materials, shear, tension, compression, working stresses, design of riveted joints in pipes and cylinders, stresses in simple and cantilever beams, investigation and design of columns, torsion in shafting for transmitting power, resilience of materials. Text, Merriman's Mechanics of Materials. Time, four hours per week. Prerequisites, C. E. 5; Physics 1 and 2. II, 4.

(7) **Agricultural Mechanics.**—This course is especially designed to meet the requirements of the agricultural students and will include a study of farm structures, machines, etc., from the standpoint of mechanics. The course will also include a study of the design and operation of the gasoline engine. Time, three hours recitation per week. II, 3.

(8) **Hydraulics.**—Theoretical hydraulics; hydraulic measurements; flow of water through orifices, over weirs, through pipes, conduits, and canals. Time, three hours recitation per week. Text, Merriman's Hy-

draulics. Prerequisites, C. E. 1, 1a, mathematics to and including calculus, physics 1 and 2. I, 3.

(9) **Irrigation Engineering.**—This includes the impounding, diverting, and conveying of water; flumes, ditches, methods of measuring the duty of water and its relation to climate, soils, etc. Drainage of swamp and alkali lands. Two hours recitation per week. Text, Wilson's Irrigation Engineer. Prerequisites, C. E. 1 and 1a, 4 and 4a. Hydraulics must be taken in conjunction with this course. I, 2.

(10) **Drainage and Irrigation.**—Theory and practice of irrigation. The principles underlying the application of water to growing crops. Duty of water and its relation to climate, soils, etc. Prevention of alkali and the reclamation of swamp and alkali lands. Time, three hours per week. Lectures and recitations. Text, King's Irrigation and Drainage. Prerequisites, C. E. 1 and 1a.

(11) **Field Practice.**—Practice in the use of engineering instruments in the field. This work is designed specially to develop speed and accuracy and to give practice in the more difficult problems of engineering. Advanced draughting during inclement weather. Time, seven and a half hours per week. Regular in civil engineering course. I, 3.

(12) **Seminar.**—In this course the student is assigned some engineering topic, and is required to deliver a lecture upon same; after the lecture the meeting is thrown open for general discussion. Each week a student is selected, by the professor in attendance, to preside at the meeting. The object of the course is to familiarize the student with recent engineering works, to assist in English composition and public speaking, and to point out the essential features of engineering articles. By means of the reflectoscope, which forms a part of the department's equipment, the student is enabled to give illustrated lectures. Time, one hour recitation period per week. I, 1. II, 1.

(13) **Roofs and Bridges.**—Theory and calculation of stresses in roof and bridge trusses. Analytical and graphical methods employed. Time, two hours recitation per week; C. E. 13a, being a part of this course. Prerequisites, C. E. 5 and 6. Text, Merriman-Jacoby's text book on Roofs and Bridges. II, 2.

(13a) **Engineering Design.**—The draughting and design of bridges, roof trusses, etc. This is part of the course in roofs and bridges and must be taken in conjunction with the same. Time, 8 hours per week. II, 4.

(14) **Sanitary Engineering.**—Collection, purification and distribution of water; systems of water supply and sewerage; disposal of sewerage; house drainage; sanitary inspection. Time, two recitations per week. Text, Folwell's Sewerage. Prerequisites, C. E. 4, 4a, 5, 6, 8, 9, and M. E. 24.

(15) **Cement Tests.**—Study of physical properties of cement. Testing the various natural and hydraulic cements under varying conditions

and mixtures. Time, two and one-half hours per week. Text, Taylor's Cement Testing. II, 1.

(16) **Reservoirs and Dams.**—This course is designed to supplement the course in irrigation engineering. Study of the best methods of impounding water. Design and construction of earth, rock-fill and timber dams. Time, one hour recitation per week. Regular junior study C. E. course. II, 1.

(17) **Geodetic Surveying.**—Elements of geodesy. Base line measurements, triangulation, determination of true meridian and latitude. Time, two hours recitation per week. Text, Johnson's Surveying. Regular senior study of C. E. course. I, 2.

(18) **Water Power Development.**—A course in the development of water power. The design and use of the turbine, impulse and other forms of water motors. The design and construction of headraces, spillways, etc. The class will be required, whenever possible, to examine water powers, and report upon their design and method of development. Considerable time will be devoted to the description of recently installed plants as published in the engineering journals. Time, three hours recitation per week. Text, Merriman's Hydraulics, Reference, Church's Hydraulic Motors. Prerequisites, C. E. 1, 1a, 5, 6, 8, and M. E. 24. I, 3.

(19) **Engineering Design.**—This course is devoted to the design of engineering works, maps, etc. Time, six hours per week. Regular study in C. E. course. II, 3.

(20) **Field Practice.**—This course is designed to give practice in the most advanced surveying. Where the nature of the thesis is such as to require advanced surveying, or laboratory investigation, this period may, at the discretion of the class officer, be used to assist in preparation of the thesis. Time, five hours per week. I, 2.

(21) **Foundations and Masonry.**—This course includes a study of materials and methods employed in the construction of piers, abutments, masonry dams, and retaining walls; economy of construction, strength of joined materials; composition of different kinds of mortar; reinforced concrete construction. Time, 3 hours recitation per week. Text, Baker's Foundations and Masonry. Regular in C. E. course. I, 2.

(22) **Hydrographic Surveying.**—This branch of surveying embraces the methods of surveying bodies of water; determining the contour of bottoms of harbors; depths of soundings; the position of channels and shoals; measurement of streams and ditches. Time, one hour recitation per week. Text, Johnson's Theory and Practice in Surveying. Prerequisites. C. E. 1, 1a, 4, 4a, 8.

(23) **Contracts and Specifications.**—The elementary law of contracts and its application to engineering considered, together with the correct form of specifications and the judicial interpretation placed on the techni-

cal terms commonly used in engineering specifications. Time, 3 hours per week. Text, Johnson's Contracts and Specifications. Elective to all engineering students after the sophomore year. II, 3.

(24) **Practical Astronomy.**—A short course in astronomy designed especially for the civil engineering students and to supplement the astronomy of mathematics. Time, two hours per week. A considerable portion of the time in this course will be given in the form of evening work in taking observations on the circum-polar stars, and a part of the time to solar observations. Text, Comstock's Field Astronomy for Beginners. Prerequisites, mathematics, 6. II, 2.

(25) **Cost of Construction.**—This course is designed to acquaint the student with the cost of labor and materials used in engineering construction; to point out the necessity and methods of keeping accurate records of the cost of proposed engineering surveys, and construction work. Time, two hours per week recitation. Text, Gillette's Cost Data. Prerequisites, C. E. 1, 1a, 4, 5, 6, 8, 13 and 13a. II, 2.

(27) **Thesis**—The student will be required before graduation to present a suitable thesis upon some engineering subject in the line of his course. A copy of the same, together with all original maps, tables, etc., typewritten, bound, and upon specified paper, will be filed with the college and become its property. The student is required to select his subject at the beginning of the senior year. I, II, 5.

(28) **Electives.**—Students will be permitted to take any electives for which they are qualified and for which they have the time. The selection will be subject to the approval of their class officer and the instructor teaching the subject.

(29) **Elementary Drawing.**—This course is designed to teach the students the use of draughting instruments; projection and isometric drawing; mapping and lettering. The course has been arranged to harmonize with Art 3, and is specially designed for the civil engineering students or those students requiring a special knowledge of mapping and field sketching. Time, six hours per week. I, 3.

(30) **Graphic Statics.**—This course is designed to lead up to the course in roofs and bridges, and to familiarize the student with the graphical methods of making solutions to problems. C. E. 5 is a prerequisite to, or must be taken in conjunction with this course. Text, Hoskin's "Elements of Graphic Statics." Time, two hours recitation per week. I, 2.

ELECTRICAL ENGINEERING.

PROF. THALER.

The electrical engineering department occupies a two story stone building, 36x52 feet. The first floor contains the dynamo laboratory, the machines for testing the strength of materials and two steam engines. The second floor contains a class and drafting room, an arc light room, a battery room, a photometer room, and an office. Steam and electrical power are obtained from the main power house.

The equipment of the electrical laboratory is very complete, with apparatus of modern type. There are two double current multipolar generators, capacity 15 K. W. These machines may be driven by the 40 H. P. engine or by the laboratory motor, and may be used as direct current dynamos, as alternators, simple, two or three phase, as synchronous motors or as rotary converters.

The two machines are also used for practice in synchronizing, and furnish alternating current for the induction motors, and for the mercury arc rectifier. For direct current work the laboratory contains in addition to the two generators, one Excelsior 15 light arc dynamo, connected to eight series-arc-lamps, arranged for testing purposes, one 15 H. P. Northern Electric Co. motor, one 10 H. P. Siemens and Halske motor and one 16 H. P. Western Electric Co. bipolar motor. Each motor is provided with a friction brake and other auxiliary apparatus for complete tests of the armature and field resistances, of the magnetic distribution and leakage, and of the efficiency and regulation at different loads; one a 6 K. W. Excelsior dynamo may be used as either a shunt or a compound machine, and is driven by the 10 H. P. motor and arranged for testing purposes.

For alternating current work the laboratory contains, in addition to the two generators, one mercury arc rectifier, capacity 30 amperes at 110 volts; one 2 H. P. single phase Westinghouse induction motor with phase splitter, provided with a prony friction brake for efficiency and regulation tests at different frequencies and at different voltages; one 6 H. P. three phase General Electric Co. induction motor, also provided with auxiliary apparatus for testing purposes.

There are six transformers, with capacities from 1 to 1½ K. W. and with different ratios. The transformers are ararnged for testing the core losses, the copper losses, and the efficiency and regulation at various frequencies and voltages. They are also used for practice in transformer connecting for different purposes.

For general testing the laboratory contains one stationary lamp bank of 136 incandescent lamps with a current capacity of 130 amperes at 110 volts; the lamps are arranged so that the current can be regulated within a small fraction of one ampere; four portable lamp banks of ten

lamps each, arranged so that the lamps can be connected either in series or in parallel; one 900 Ohm iron wire resistance and five iron wire resistances for heavy currents, besides a number of rheostats, switches and circuit breakers.

The laboratory contains twenty-nine electrical measuring instruments, including nine voltmeters; one Whitney 150-300 volts; one Whitney 15 volts; one Weston 150 volts; one Weston milli-voltmeter; one Weston 75-150 volt A. C.; one Westinghouse 150 volts switchboard voltmeter.

We have eight portable ammeters: one 5 ampere D. C. Weston, three Whitney ammeters, capacity 10, 25 and 50 amperes, D. C., respectively; two Hoyt's A. C. ammeters, 10 and 30 amperes respectively; one G. E. ammeter with series transformer, 120 amperes A. C.; and one Westinghouse ammeter, 120 amperes.

We have four portable wattmeters; one Westinghouse, with series transformer, capacity 100 amperes at 200 volts; one Hoyt, capacity 1500 K. W.; one Weston, with multiplier, 2 amperes at 2250 volts; one G. E. Co. wattmeter, capacity 10,000 watts.

There is one Leeds potentiometer with standard cell and standard resistances for calibrating instruments; one Kelvin standard balance for calibrating wattmeters; one Weston portable galvanometer; one Jacobi testing set for measuring resistances; and four intergrating wattmeters, besides several switchboard instruments.

The arc light room contains eight series-arc-lamps and five constant potential arc lamps of different types arranged for testing.

In the photometer room is a Willyoung station photometer with universal rotator and bunsen screen for testing the candle power, distribution of light, and the efficiency of incadescent lamps.

The battery room contains a storage battery of 36 cells at 60 ampere hours capacity, of the following types: 10 chloride accumulators, 10 National Battery Co.'s unit accumulator, 10 Willard cells and 6 American cells. The batteries furnish current for calibrating instruments and are also available for testing purposes.

The office contains a 700 candle power Cooper-Hewitt mercury vapor lamp, a Nerst lamp, and the apparatus for calibrating instruments.

A 150,000 volt testing transformer for testing insulation resistances has been added to the laboratory equipment during the past year.

(1) **Electrical Machinery.**—Lectures on the construction, care and operation of commercial electrical machines and apparatus, including batteries, electric lights, dynamos, motors, alternators, transformers and electrical measuring instruments. Text book, Introduction to Electrical Engineering by H. H. Norris. Soph. II, 2.

(2) **Dynamo Drawing.**—Detail working drawing, tracing, and blue printing of electrical machines in the laboratory, to familiarize the stu-

dent with the conventional methods of representing the different parts of dynamos and motors. Soph. II, 2.

(3) **Applied Electricity.**—Methods and calculations of wiring, theory of primary cells and storage batteries, electric light and electrical measuring instruments. Two recitations and one lecture per week. Prerequisites, Calculus and Physics (1). Textbook, Elements of Electrical Engineering, by Franklin & Esty. Jr. I, 3.

(4) **Electrical Laboratory.**—Tracing circuits and wiring, calibrating instruments, efficiency tests of storage batteries, and the candle power of incandescent lamps. Five hours laboratory work per week. Prerequisites; Physics (2). Text book, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Jr. I, 2.

(5) **Dynamos and Motors.**—Principles of electro-magnetism, theory of dynamo electric machines, the design, construction and regulation of direct current dynamos and motors. Three recitations and one lecture per week. Prerequisites, Physics (1) and Calculus. Text book, Elements of Electrical Engineering, by Franklin & Esty. Jr. II, 4.

(6) **Dynamo Testing.**—Laboratory tests to determine armature and field resistance, magnetic leakage coefficients, characteristic curves and the efficiency and regulation of various types of direct current machines. Five hours laboratory work per week. Prerequisites, Physics (2) and (6). Text book, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Jr. II, 2.

(7) **Electrical Diagrams.**—Conventional methods of representing electrical wiring and appliances. Drawings and wiring diagrams of the switchboards in the laboratory and in the power house and diagrams of the wiring of the college buildings. Four hours drawing per week. Jr. I, 2.

(8) **Dynamo Design.**—Problems in designing electro-magnets, dynamos and motors. Complete working drawings and specifications to accompany each design. Six hours per week. Prerequisite, dynamo drawing. Reference, Design of Dynamos, by S. P. Thompson. Jr. II, 3.

(9) **Alternating Currents.**—Theory of alternating currents, properties of alternating current circuits, principles of alternators, transformers, rotary converters and induction motors, methods of testing alternating current apparatus. Three recitations and one lecture per week. Prerequisites, Physics (5). Text book, Alternating Currents, by Franklin & Esty. Sr. I, 4.

(10) **Single Phase Testing.**—Laboratory tests of single phase alternating current generators, motors and transformers, calibration of alternating current measuring instruments and meters. Seven and one half hours laboratory work per week. Prerequisites, Physics (6). Text book, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Sr. I, 3.

(11) **Alternating Currents.**—Development of the symbolic method of

Steinmetz, the solution of problems in transformer design and calculation by vector diagrams. Two recitations and two lectures per week. Pre- of transmission line by the use of the algebra of complex numbers and requisites, alternating currents (9). Text book, Alternating Current Phenomena, by Steinmetz. Sr. II, 4.

(12) **Polyphase Testing.**—Laboratory tests of polyphase alternating current apparatus, including generators, motors, transformers and con verters. Efficiency and regulation tests of a mercury arc rectifier, connection of transformers for transforming from three phase to two phase. Prerequisite, alternating current testing. Text book, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Sr. II, 2.

(13) **Transformer Design.**—Design and drawing of transformers to conform with certain specifications of efficiency and regulation. Calculation of the cost of the transformer. Six hours designing and drawing per week. Open to students taking E. E. 9 and 11. Sr. I. 3.

(14) **Contracts and Specifications.**—The law of contracts and its application to engineering contracts. Students are required to make specifications for estimates on proposed power plants, transmission lines or electrical apparatus. Text book, Contracts and Specifications, by Johnson, and Electrical Lighting Specifications by Merrill. Sr. II, 1.

(15) **Power Plant Operation.**—Practice in the operation and care of boilers, engines, dynamos, motors, electric lights and storage batteries of the college power plant. Sr. I, 1.

(16) **Alternator Design.**—Problems in designing alternators, converters and induction motors. Design and specifications of alternating current circuits. . Six hours designing and drawing per week. Prerequisites, alternating currents (9). Sr. II, 3.

(17) **Seminar.**—Weekly meeting for the purpose of discussing current electrical engineering literature. One hour per week for seniors and juniors. Jr. and Sr. I. and II, 4.

(18) **Special Design.**—Design and construction of some special electrical apparatus or machine. Elective for seniors. Sr. I or II, 3.

(19) **Inspection Trips.**—Annual excursions are made to one of the large power plants. Students are required to observe and make a report of the type and arrangement of the apparatus and of the methods of operation. Required of seniors in electrical engineering.

(20) **Thesis.**—Before graduating each student must present a suitable thesis upon some engineering subject in line with his course. One copy of the thesis will be filed in the college library as the property of the college. The subject for the thesis must be chosen at the beginning of the senior year. Sr. I and II, 5.

(21) **Elementary Drawing.**—Plain lettering, the use of instruments, geometrical problems, orthographic, isometric, and cabinet projections of simple objects. Fr. I, 3.

MECHANICAL ENGINEERING.

PROF. COUPER.

ASSOCIATE PROF. DEARBORN.

In selecting and specifying the required work of the mechanical engineering course the idea has been to give the student a knowledge of and some practice in those subjects that are essential in his preparation for the various lines of work generally recognized as belonging to this profession. Where the work of the mechanical engineer overlaps that of the civil or electrical engineer subjects from those courses are included in the requirements of this course, thus giving the student as complete a preparation as could reasonably be demanded of him.

For the drawing in this course there are provided two large well lighted rooms on the top floor of the main building. In one of these rooms there are twenty-eight and in the other twenty double desks, accommodating in all ninety-six students. The college furnishes the drawing boards. The students furnish their own instruments, triangles, scales, etc. For instruction in drawing there are numerous models, parts of machinery, blue prints and drawings. The work in drawing is carried on in conjunction with class work in the study of machines, engines and boilers, and in the design of them. Working drawings comprise a considerable portion of the work and in this way the close relation of the drafting room to the shop is emphasized, as the work in the shops is carried on by the use of working drawings similar to those made in the drawing room. The work includes designing, which in addition to applying the principles of machine design developes a certain degree of originality in invention. A blue printing outfit is a part of the equipment of the drawing room.

In the laboratory work of this course the apparatus and experiments are selected to demonstrate as far as possible the class work in the study of engines and boilers and in designing of machinery.

For engine tests there are available an 8x12 high speed Woodbury engine and a vertical 7x7 Detroit engine, in the mechanical engineering laboratory; a 65 H. P. Imperial engine in the college power plant; a compound Advance traction, owned by the college, and a Russell traction engine loaned for experimental purposes. The Woodbury engine is belted to two 15 K. W. generators, which are used to put a load on the engine. The engine has connections and reducing motion for steam engine indicators. A friction brake is fitted to one of the fly wheels, which is flanged to allow for a means of cooling it with a stream of water, thus making it possible to carry on tests of considerable duration. The steam piping is so arranged that the engine may be run condensing or noncondensing, with or without live or exhaust steam in the jackets. The exhaust is connected to a 50 H. P. Dean Bros. surface condenser. The condensed

steam is weighed in tanks placed on Howe scales of 1200 lbs. capacity. The water used for condensing the steam may be measured by a weir or by meters. The 7x7 vertical engine is also provided with the necessary connections and reducing motion for indicator work, and a friction brake for loading the engine. The engine may be connected with the condenser. The eccentric is adjustable on the shaft, and practice is given the student in setting the valve, which is of the piston stype, by measurements as well as by using the steam engine indicator.

For steam engine indicator work there are two Crosby and one Thompson indicator. The Crosby indicators have electro-magnetic attachments for taking cards simultaneously from each end of the cylinder. There are several reducing motions of the wheel, pantograph and pendulum types; also a planimeter for obtaining the area of indicator cards. The accuracy of indicator springs is tested by attaching the indicator to a drum in which the steam pressure can be regulated, by valves, from zero to boiler pressure. The pressure is obtained by an accurate test gauge attached to the drum. With these instruments the student learns to determine the horse power developed by the engine, to judge whether the valves are properly set, and the method of setting valves correctly.

Boiler tests are made on the water tube and horizontal multi-tubular boilers of the power plant and on the two traction engines already mentioned. For this work there are provided tanks, scales, thermometers, pyrometers, steam gauges, etc. A new Crosby steam gauge testing outfit affords a means of calibrating all the gauges used in this work. Schaeffer and Budenburg throttling and separating calorimeters are used to determine the condition of the steam. A No. 6 Lunkenheimer injector is used in making tests of the capacity and efficiency of this class of apparatus.

An aluminum Corliss valve model about two feet long, having all the parts of a valve of this class, is used to show the action of the valves and the method of adjusting the valve gear. A plain slide valve model about four feet long, designed and built at the college, gives opportunity to study, under favorable conditions, all the variations to which a slide valve is subject. This model is very carefully constructed and graduated so that it may be used for checking slide valves designed to fulfill various conditions.

A Riehle testing machine of 100,000 lbs. capacity is used for testing the strength of materials used in engineering and to confirm formulas and values used in machine design and structural work. This machine is provided with all the necessary grips and blocks for making tension, compression and transverse tests of metals, woods, stones, bricks and cement. A magnetic friction clutch may be used to automatically adjust the balance. Mounted on the machine is an automatic attachment for obtaining the characteristic curves of materials subjected to the various

stresses. In addition to these is an extensiometer with double micrometer screws reading to ten-thousandths of an inch and deflectometer reading to thousandths of an inch.

Torsion tests are made on an Olsen torsion machine, capable of breaking a specimen one and one quarter inches square. For measuring specimens there is a two inch micrometer caliper and a twelve inch steel scale. Specimens to be tested are prepared in the shop, thus giving the students additional opportunity to become acquainted with the characteristics of the materials used in engineering and to appreciate more fully the objects and results of the tests. Samples of the specimens are analyzed by the chemical department and the results recorded with the tests.

The shops of the college are equipped with standard machinery and tools for working wood and iron. This equipment is being constantly added to as required, both by purchase and by manufacture in the shops.

The forge shop is 28x36 feet and contains eleven Buffalo down draft forges, operated by Sturtevant blowers, as well as a full equipment of anvils and small tools. A fifty pound trip hammer, shear, Gisholt tool swage blocks, etc., are also included. In the work here a graded series of exercises leads the student from simple drawing and upsetting to size, to complex forging and tool making, hardening and tempering, all the work being done from working drawings.

There is a brass foundry 24x28 feet, equipped with brass furnace, core oven, crucibles, flasks, patterns, etc. The work comprises bench and floor moulding, melting, pouring, etc., and is carried on in conjunction with pattern making, lectures pertaining to both general foundry practice and pattern making being given at the same time.

The machine shop is a room 60x72 feet. Adjoining the general machine shop are the tool room, stock room, office, lavatory and locker room. The equipment includes an 18 inch Davis & Egan, a 16 inch LeBond and three 16 inch Flather engine lathes, a 22 inch Flather planer, 16 inch Davis & Egan shaper, a 28 inch Cincinnati universal milling machine, a 24 inch sensitive drill, a No. 1 Cincinnati universal milling machine, a 24 inch Barnes grinder, 4 inch pipe machine, speed lathe, power hack saw, etc., and in the tool room a Cincinnati universal grinder, a Gisholt tool grinder, drill grinder, etc., besides a complete equipment of small tools. A tool checking system affords additional means of illustration of modern practice.

The wood shop is a room 36x50 feet and is furnished with modern wood working machinery, including a 20 inch planer, 14 inch circular pattern saw, 36 inch saw, universal jointer, jig saw, trimmer, mortiser, 16 inch pattern lathe, seven 10 inch turning lathes with tools, and fifty-six complete sets of carpenter tools, with benches for joinery, cabinet work and pattern making.

(1) **Mechanical Drawing**—The use of drawing instruments and plain lettering; problems in geometric construction to teach accuracy in the

use of instruments; isometric and cabinet projections and simple perspective. Fr. I, 3. Prof. Couper.

(2) **Joinery.**—A graded set of problems is given with instruction in the proper use and care of carpenter's tools and practice in working to dimensions from blue prints. Fr. I, 2. Prof. Dearborn.

(3) **Descriptive Geometry.**—Projections of lines, plane surfaces and solids; intersections, tangents to curves and surfaces; problems in warped surfaces; practical applications. Text, Faunce Fr. II, 2. Prof. Couper.

(3a) **Mechanical Drawing.**—Problems in descriptive geometry; finding the position of points, lines and surfaces; inter-section of solids, development of surfaces; making patterns for such objects as bath tubs, boiler sheets, and other sheet metal work. Fr. II, 3. Prof. Couper.

(4) **Foundry and Pattern Making.**—Includes practice in floor and bench molding, core making, and pouring, with lectures on general foundry practice. Also a series of exercises in wood turning and pattern-making and the use of wood working machinery. Fr. II, 2. Prof. Dearborn.

(5) **Kinematics**—A study of the relative motions of machine parts, including belting, toothed gears, cams and linkages. The class room work is supplemented by a parallel course in drafting. Text, Schwamb & Merrill, Elements of Mechanisms. Soph. I, 2. Prof. Couper.

(5a) **Mechanical Drawing.**—Applications of the principles of kinematics and drawing velocity diagrams, spur and bevel gears and cams. Soph. I. 3. Prof. Couper.

(6) **Forge Work.**—A graded set of exercises in iron forging, designed to teach the operations of drawing, upsetting, forming and welding, with lectures on the manufacture and properties of iron and steel, standard specifications, etc. Soph. I, 2. Prof. Dearborn

(7) **Steam Engines and Boilers.**—A study of the different types and their classification. A description of the various parts and their uses, together wth a careful study of combustion and the properties of steam. The care and operation of engines and boilers as regards safety and economy. Text, Spangler, Green and Marshall, Elements of Steam Engineering. Soph. II, 2. Prof. Dearborn.

(8) **Kinematics.**—A continuation of Kinematics (5). Soph. II, 2. Prof. Couper.

(8a) **Mechanical Drawing.**—A continuation of mechanical drawing. (5a). Soph. II, 1. Prof. Couper.

(9) **Forge Work.**—A continuation of the work in iron forging, together with the making of steel tools, including tempering, annealing and case-hardening. Soph. II, 2. Prof. Dearborn.

(10) **Mechanical Drawing.**—A continuation of mechanical drawing (8a) in which the work will be detail drawings of machine parts preparatory to the work of machine design. Jr. I, 1. Prof. Couper.

(11) **Seminar.**—Weekly meetings held to discuss current engineering

literature. Jr. II, 1; Sr. I, 1. Prof. Couper and Prof. Dearborn.

(12) **Machine Work.**—Bench work, including chipping, filing, fitting, scraping, laying out work from blue prints; with lectures pertaining to the work. Prerequisites M. E. 4, 6 and 9. Jr. I, 2. Prof. Dearborn.

(13) **Machine Design.**—Class room work, in the study of machines in regard to size, form and strength. The developments and the application of mathematical formulae to the solution of problems in designing machinery. Prerequisites, M. E. 5 and 5a and C. E. 5. Text, Jones's Machine Design. Jr. II, 3. Prof. Couper.

(13a) **Mechanical Drawing.**—Application of the principles of machine design to size, form and strength of machines and machine parts. Jr. II, 3. Prof. Couper.

(14) **Strength of Materials, Laboratory.**—Each student is required to make a definite series of tests of wrought iron, cast iron, steel and wood in tension, compression, bending and torsion. Prerequisites, C. E. 5. Jr. II, 1. Prof. Couper.

(15) **Indicators and Valve Gear.**—A study of the slide valve, both in its simple form and in combination with independent cut-off valves, link motions and other reversing gears; automatic cut-off gears, the Zeuner diagram; principles and operation of the indicator. Prerequisites, M. E. 7. Text, Spangler's Valve Gears. Jr. II, 2. Prof. Couper.

(15a) **Mechanical Laboratory.**—Setting of valves with and without the use of the steam engine indicator. Testing of indicator springs and determining the horse power of engines by using the indicator and brake. Each class designs and constructs a reducing motion for some engine or pump. Prerequisites, M. E. 7. M. E. 15 must be carried in conjunction with this subject. Jr. II, 1. Prof. Couper.

(16) **Boiler Room and Engine Practice.**—Each student spends five hours per week as assistant in the college power plant, obtaining practical experience under a first-class engineer in handling boilers, pumps, engines, heating apparatus and electrical machinery, including dynamos, motors and switch board. Soph. II, 2. Prof. Dearborn.

(17) **Machine Work.**—Instruction and practice in lathe work, drilling, boring, thread and gear-cutting, with lectures. Prerequisite, M. E. 4, 6, 9, 12. Jr. II, 2. Prof. Dearborn.

(18) **Thermodynamics.**—A thorough course in theory, and its application, especially to steam engines. Prerequisites, Phys. 1 and 2, M. E. 7, 15 and 15a. Text, Peabody, Thermodynamics of the Steam Engine. Senior. I, 3. Prof. Dearborn.

(19) **Boiler Design.**—A study of steam boilers with reference to setting, capacity, strength and construction. Specifications of material to be used and method of handling. Prerequisite, M. E. 7, 13, 14 and 16. Text, H. De B. Parsons, Steam Boilers. Sr. I, 1. Prof. Couper.

(19a) **Mechanical Drawing.**—A completion of the drawing in machine

design and the making of drawings for a steam boiler. Prerequisite, M. E. 13 a. Sr. I, 2. Prof. Couper.

(20) **Mechanical Laboratory.**—Calibration of instruments and apparatus for testing, including indicator springs, steam gauges, meters, scales and reducing motions; testing of injectors, condensers, boilers, steam and gas engines, together with calorimetric determination of the condition of steam by means of both the separating and throttling calorimeters. Testing of flue gases and the determination of the calorific values of coals. Complete test of power plant. Prerequisite, M. E. 7, 15 and 15a. Sr. I, 3. Prof. Couper.

(21) **Machine Work.**—Advanced work on lathe, grinder and milling machine; tool making. Prerequisite, M. E. 17. Sr. I, 2. Prof. Dearborn.

(22) **Thermodynamics.**—The laws of thermodynamics as applied to gas engines and refrigerating machinery. Prerequisite, M. E. 18. Text, Peabody. Sr. II, 2. Prof. Dearborn.

(23) **Engine Design.**—The constructive details of some type of automatic cut-off engine will be worked out in the class room, and working drawings thereof made. Prerequisite, M. E. 7, 13, 14, 15, 15a, 16, 18. Text, Whitman, Steam Engine Design. Sr. II, 2. Prof. Couper.

(23a) **Mechanical Drawing.**—Designing and drawing of plans for engines and steam appliances. Sr. II, 2. Prof. Couper.

(24) **Contracts and Specifications.**—The various forms of contracts and the value and necessity of legal contracts will be given by some lawyer. The work in specifications will be to examine the common forms in use and write up complete specifications for some engineering project. Text, Johnson, Contracts and Specifications. Sr. II, 1. Prof. Couper.

(25) **Shop Management.**—Lectures on the organization and arrangement of manufacturing plants; cost accounting, shop methods, duplication of work. Prerequisite, M. E. 21, Sr. II, 1. Prof. Dearborn.

(26) **Thesis.**—Before graduation each student must present a suitable thesis, the result of original investigations. The subject must be chosen at the beginning of the senior year. Sr. I, II, 3. Prof. Couper.



LIBRARY.



MINERAL MUSEUM.

Division of Science

The college offers six separate courses leading to the degree of bachelor of science, which are tabulated on the following pages. It will be noted that in these tabulations there is but little change in the actual requirements from the work offered during the past eight years. In the earlier years of the course, as heretofore, much of the foundation work in science, language and mathematics is common to all the courses.

The names given to these courses are generally indicative of their nature.—Biology, Chemistry, Home Science, History-Literature, Mathematics-Physics, and Pharmacy.

Candidates for the bachelor's degree in science must complete satisfactorily not less than 130 credits, including the prescribed work in military drill or domestic science; and including also a thesis, the value of which in credits shall be determined by the instructor concerned. No regular student may take in any one semester work amounting to more than nineteen credits or less than twelve.

Students who are relieved for any reason of the requirements in military drill or domestic science, shall present four additional credits in some other subject; but the president may, at his discretion, excuse from such requirements any student in the employ of the institution.

Several subjects taught in departments not represented in this division are open to election by students in science on consent of their advisers. Among these may be mentioned music. (limited to four credits for any one person) and such subjects in the divisions of agriculture or engineering as the applicants may be qualified for, and as the schedule permits. In general the credits to be allowed for these are to be determined by the agreement of the instructors concerned.

A more detailed statement of the direct purpose of these courses may be found just preceding the tabulation of each course.

Biology

Through the electives allowed in the biology course the student may select lines leading toward the following professions: general zoology, general botany, economic entomology, plant pathology, and bacteriology. The course also furnishes an excellent preliminary trainiing for the professions of medicine, veterinary science, forestry, and teaching. In the government service, both in the Department of Agriculture at Washington and in the various experiment stations, there are many desirable openings both for young men and young women. In plant pathology, bacteriology, and entomology there is a growing demand for suitably qualified workers. Women are more and more in demand as scientific clerks and assistants. The passage of the Adams act whereby the federal appropriation to the experiment stations in the various states is materially increased, is creating a greater demand for workers in biological as in other lines, and as never before the outlook in these lines is inviting.

The biology course is characterized by wide privileges in electing, but it is intended that the student shall be guided by his class officer in selecting the subcourses that contribute most directly to his chosen line of work.

For graduation from the course in biology, one year of Latin and a reading knowledge of French and German are required. More of each is desirable but as soon as these amounts are accomplished, the student may elect other subjects in place of foreign language.

BIOLOGY.

FRESHMAN YEAR.

First Semester.		Second Semester.	
Invertebrate Zoology (Biol. 1)	5		
Inorganic Chemistry (Chem. 1)	4	Vertebrate Zoology (Biol. 2)	4
English Composition (Eng. 1)	2	Inorganic Chemistry (Chem. 1)	4
Foreign Language	4	English Composition (Eng. 1)	2
Drawing from Nature (Art 4)	1	Foreign Language	4
Drill or Domestic Science	1	Drawing from Nature (Art 4)	3
Public Speaking	1	Drill or Domestic Science	1
	18		18

SOPHOMORE YEAR

General Botany (Biol. 9)	5	Plant Physiology and Histology, (Biol. 10)	4
Organic Chemistry (Chem. 5)	3	Organic Chemistry (Chem. 5)	3
Algebra and Trigonometry, (Math. 1 and 2)	5	Analytic Geometry (Math. 3)	4
Expository Composition (Eng. 2)	2	Expository Composition (Eng. 2)	2
Foreign Language	4	Foreign Language	4
Drill or Domestic Science	1	Drill or Domestic Science	1
	20		18

JUNIOR YEAR.

General Entomology (Biol. 4)	4		
or Bacteriology (Biol. 12)	4		
General Descriptive Physics, (Phys. 1a)	3	Animal Physiology (Biol. 3)	4
Geology (Geol. 1)	2	General Descriptive Physics, (Phys. 1a)	3
English Literature (Eng. 10)	2	English Literature (Eng. 10)	2
Foreign Language	4	Foreign Languages	4
Elective	1-4	Elective	3-6
	16-19		16-19

SENIOR YEAR

Advanced English Composition or Literature (Eng. 3 or 11)	2	Advanced English Composition, or Literature (Eng. 3 or 11)	2
Economics (3)	2	Economics (3)	2
Psychology (1)	3	Ethics (2)	3
Thesis	5	Thesis	5
Elective	4-7	Elective	4-7
	16-19		16-19

Chemistry

The principles of chemistry together with some of the applications of the science are taught to the freshmen in all courses offered by the college. In addition to this elementary instruction some departments, require sufficient training in chemistry to enable the student to apply the principles of the science to some special phase of the general course he is pursuing. This is true in the college courses in agriculture, domestic science and sanitary engineering. However students who wish to follow chemistry as a profession are advised to take systematic training in the science during the four years of undergraduate study.

The outline of studies offered in the chemical course is designed to meet the needs of this class of students. It is believed such a course should provide a liberal education along with as much technical skill as it is possible to obtain. With this end in view and with the idea that the chemical training should have some definite aim, two options are offered. One option gives a training in the various branches of chemistry together with several fundamental courses in biology and agriculture, the other option combines a number of carefully selected engineering studies with the chemistry.

The agriculturual option gives an excellent foundation for the future study of almost any phase of agricultural science. Especially it leads to agricultural chemistry as applied in experiment station laboratories. The engineering option offers a combination of studies which approaches what is usually known as a course in chemical engineering. It prepares for positions in chemical laboratories connected with manufacturing industries and for managing plants and operations requiring a working knowledge of both chemistry and engineering.

In the following schedule of studies, those subjects marked with one star (*) are required only of those who elect the agricultural option. The studies required in the engineering option are marked with two stars (**), while the unstarred subjects are required of all students who take the chemical course. The freshman year is the same for both options.

CHEMISTRY.

FRESHMAN YEAR.

First Semester.		Second Semester.	
Algebra (Math. 1)	3	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	General Chemistry (Chem. 1)	4
General Chemistry (Chem. 1)	4	English Composition (Eng. 1)	2
English Composition (Eng. 1)	2	French or German	4
German or French	4	Descriptive Geometry (M. E. 3)	2
Mechanical Drawing (M. E. 1)	3	Mechanical Drawing (M. E. 3a)	2
Drill	1	Drill	1
	19		19

SOPHOMORE YEAR

		Quantitative Analysis (Chem. 3)	4
		Drill	1
English Composition (Eng. 2)	2	*Animal Physiology (Biol. 3)	5
Qualitative Analysis (Chem. 2)	4	*Physics (1a)	3
Drill	1	*German or French	4
*Invertebrate Zoology (Biol. 1)	5	*Geology (1)	2
*Physics (1a)	3	**Calculus (Math. 4)	5
*German or French	4	**General Physics (Phys. 1)	3
**Calculus (Math. 4)	5	**Physical Meas. (Phys. 2)	2
**General Physics (Phys. 1)	3	**Elect. Machinery (E. E. 1)	2
**Physical Meas. (Phys. 2)	2	**Steam Engines and Boilers, (M. E. 7)	2
**Kinematics (M. E. 5)	2		

JUNIOR YEAR.

Organic Chemistry (Chem. 5)	3	Organic Chemistry (Chem. 5)	3
Physical Chemistry (Chem. 6)	3	Physical Chemistry (Chem. 6)	3
Quantitative Analysis (Chem. 3)	4	*Agricultural Anal. (Chem. 4)	3
*Mineralogy (Chem. 11)	3	*Bacteriology (Biol. 12)	5
*General Botany (Biol. 9)	5	*Soil Fertility (Agronomy 5)	5
**Electricity and Magnetism, (Physics 5)	2	**Light and Sound (Phys. 3 and 4)	4
**Electrical Meas. Phys. 6)	2	**Applied Mechanics (C. E. 6)	4
**Theoretical Mechanics (C.E. 5)	4	**Strength of Material (M.E. 14)	1
		**Geology (1)	2

SENIOR YEAR

		Economics	2
Economics	2	Seminar	1
Seminar	1	Thesis	2
Thesis	2	Water and Air Analysis (Chem. 10)	2
Industrial Chem. (Chem. 9)	3	Industrial Chem. (Chem. 9)	3
*Soil Physics (Agronomy 3)	5	*Agri. Analysis (Chem. 4)	4
*Agri. Analysis (Chem. 4)	4	*Feeding Livestock	4
**Mineralogy (Chem. 11)	3	**Dynamos and Motors (E.E. 5)	4
**Thermodynamics (M. E. 18)	3	**Thermodynamics (M. E. 22)	2
**Valve Gears (M. E. 15)	2	**Assaying (Chem. 12)	3
**Mechan. Laboratory (M. E. 15a)	1		

*Required in the agricultural option only.
**Required in the engineering option only.
Unstarred subjects are required of all students who take this course.

History and Literature

In accordance with the general plan of the division of science, this course leads to the degree of bachelor of science. It includes properly therefore strong courses in physics and in chemistry or biology, though it does not contemplate advanced work in any of these subjects. Throughout the course a large amount of time is devoted to the study of foreign language and during the later years of the course a good deal of time is given to history and literature. It is not expected that that the graduate in this course will be technically equipped in any of these subjects, though by the systematic arrangement of his electives he may emphasize such lines of the work as he is especially attracted to. Graduates should therefore be fitted to teach in the high schools, history, English, and one or more of the foreign languages. The prime purpose of the course, however, is to offer to those who can afford it a good general education, the purpose of which shall be a wide acquaintance and sympathy with the most important ideas and activities of civilization.

Such an education, it is believed, is well worth having for its own sake; and for those who can afford the time, is a valuable preparation for the specialization of the graduate school, or of the professional or technical school.

HISTORY—LITERATURE.

FRESHMAN YEAR.

First Semester.		Second Semester.	
Algebra (Math. 1)	3		
Trigonometry (Math. 2)	2	Anal. Geometry (Math. 3)	4
Foreign Language (Fr., Ger., or Latin)	4	Foreign Language (Fr., Ger., or Latin)	4
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
or Invertebrate Zoology (Biol. 1)	5	or Vertebrate Zoology (Biol. 2)	4
or General Botany (Biol. 9)	5	or Plant Phys. (Biol. 10)	4
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (1)	1	Public Speaking (1)	1
Military Drill		Military Drill	
or Domestic Science	1	or Domestic Science	1
Art	1	Art	1
	18 or 19		17

SOPHOMORE YEAR

Foreign Language	6 or 7	Foreign Language	6 or 7
English Composition (Eng. 2)	2	English Composition (Eng. 2)	2
English History (Hist. 1)	2	English Literature (Eng. 10)	2
English Literature (Eng. 10)	2	English History (Hist. 1)	2
Gen. Descriptive Phys. (Phys. 1a)	3	Gen. Descriptive Phys. (Phys. 1a)	3
Military Drill		Military Drill	
or Domestic Science	1	or Domestic Science	1
Elective	0-3	Elective	0-3
	16-19		16-19

JUNIOR YEAR*

		Economics (3)	2
Economics (3)	2	Foreign Language	3
Foreign Language (3)	3	English Literature or Composition (English 3, 11, 12, or 13)	
English Literature or Composition (English 3, 11, or 13)		or History (2 or 5)	2-4
or History (2 or 5)	2-3	Constitution of U. S. (Pol. Sci. 1)	2
Elective	9-12	Elective	4-10
	16-19		15-19

SENIOR YEAR

Psychology (1)	3	Ethics (2)	3
Sociology (Pol. Sci. 2)	3	Thesis (3)	6
Elective, 9-13.		Elective 7-10	
At least 4 credits must be taken in either History, English or Foreign Language.		At least 4 credits must be taken in either History, English Foreign Language.	

* The order in which the required subjects are to be taken up in the junior and senior years may be varied upon the consent of the class officer and the instructor concerned.

Home Science

The object of this course is twofold: First, to give young women a liberal education with a scientific basis and to train them along lines pertaining to the science, management and care of the home. Second, to give training to those who wish to become teachers of home science. This course gives an opportunity for the combination of biology or chemistry with home science. Music, literature and art are elective studies.

Considerable latitude is allowed in electives. If sewing (11) and food principles (2) are not elected in the freshman year they must be taken in the sophomore year.

MUSIC STUDIO.



DOMESTIC SCIENCE DINING ROOM.

HOME SCIENCE

FRESHMAN YEAR.

First Semester.		Second Semester.	
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
French, German or Latin	4	French, German or Latin	4
Trigonometry (Math. 2)	3	Public Speaking	1
Public Speaking	1	Art	1
Art	1	Cooking (H. S. 1)	2
Cooking (H. S. 1)	1	Anal. Geometry (Math. 3)	4
Algebra (Math. 1)	3	or Food Principles (H. S. 2)	2
or Sewing (H. S. 11)	2	and Sewing (H. S. 11)	2

SOPHOMORE YEAR

		French, German or Latin	4
French, German or Latin	4	European History (Hist. 1)	2
European History (Hist. 1)	2	Physiology (Biol. 3)	4
Biology (Biol. 1)	4	Econ. Use of Food (H. S. 3)	3
Econ. Use of Food (H. S. 3)	3	Entomology (Biol. 7)	2
Garment Making (H. S. 12)	2	Garment Making (H. S. 12)	2
Elective	4	Elective	2 or 3

JUNIOR YEAR.

English Composition (Eng. 2)	2		
Economics (3)	2		
Organic Chemistry (Chem. 5)	3	English Composition (Eng. 2)	2
Bacteriology (Biol. 12)	4	Economics (3)	3
Dressmaking (H. S. 13)	1	Food Chemistry (Chem. 8)	3
Architecture and Sanitation (H. S. 4)	2	Invalid Cooking (H. S. 5)	2
		Dressmaking (H. S. 13)	1
Electives	4 or 5	Electives	8 or 9

SENIOR YEAR

Psychology (1)	3	Ethics (2)	3
Language	2	Language	2
Chem., Biol., or Phys	4	Chem., Biol., or Physics	4
Cooking Demonstrations (H.S. 6)	2	Cooking Demonstrations (H.S.6)	2
Journal Meeting (H. S. 7)	2	Journal Meetings (H. S. 7)	1
Art Needle Work (H. S. 14)	2	Dressmaking (H. S. 15)	2
Thesis and Electives	4	Thesis and Electives	4

Mathematics and Physics

This course as outlined on the opposite page is designed to fill the needs of two or three classes of students. The required work is such as to give an excellent preparation for students desiring to become teachers in these subjects and by proper choice of the electives a broad education in other subjects may be obtained. Prospective teachers are advised to arrange their electives so that they will be qualified to teach other subjects such as biology, chemistry, English or foreign language, as often they are required to teach such subjects in combination with mathematics or physics.

There is an increasing demand for men who have a more extended and exact knowledge of these fundamental sciences than can be obtained from the ordinary technical course. This call comes from a class of employers who desire men so equipped and prefer to give them the practical training they need. This course is designed to give just such training. If the student should take this course planning to take an engineering course later he can choose his electives so that any of the engineering courses may be completed in two years after graduation from the Mathematics-Physics course. In this case the following subjects are suggested from which it is desirable to elect: Freehand drawing, mechanical drawing chemistry, mechanics, applied electricity, dynamos and motors, hydraulics, sanitary engineering. The particular electives of this course will be chosen in accordance with the direct aim of the student. In addition, the above course lays a foundation for the work of the graduate school.

MATHEMATICS—PHYSICS

FRESHMAN YEAR.

First Semester.		Second Semester.	
Algebra (Math. 1)	3		
Trigonometry (Math. 2)	2	Anal. Geometry (Math. 3)	4
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (1)	1	Public Speaking (1)	1
German or French	4	German or French	4
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
Military Drill or Domestic Science	1	Military Drill or Domestic Science	1

SOPHOMORE YEAR

Calculus (Math. 4)	5	Calculus (Math. 4)	5
General Physics (Phys. 1)	3	General Physics (Phys. 1)	3
Physical Meas. (Phys. 2)	2	Physical Measurements (Phys. 2)	2
German or French	3 or 4	German or French	3 or 4
Expository Composition (Eng. 2)	2	Expository Composition (Eng. 2)	2
or English Literature (Eng. 10)	2	or English Literature (Eng. 10)	2
Elective	0 to 4	Elective	0 to 4

JUNIOR YEAR.

Differential Equations (Math. 10)	3		
Electricity and Magnetism, (Phys. 5)	2		
Physical Measurements (Phys. 6)	2	Differential Equations (Math. 10)	3
or Least Squares (Math. 5)	2	Light and Sound (Phys. 3)	2
Dyn. and Structural Geol. (Geol. 1)	2	Physical Measurements (Phys. 4)	2
Economics (3)	2	Economics (3)	2
Elective	6 to 10	Elective	6 to 10

SENIOR YEAR

Astronomy (Math. 6)	3	Astronomy (Math. 6)	3
Two Courses from Advanced Phys. (Phys. 7)	3	Two Courses from Advanced Phys. (Phys. 7)	3
Mathematics (11, 12, 13 or 14)	2 or 3	Mathematics (11, 12, 13, 14)	2 or 3
Elective and Thesis	7 to 11	Elective and Thesis	7 to 11

Pharmacy

The objects of this course in pharmacy are to furnish: (a) A thorough, scientific foundation for the pursuit of the profession. (b) A preparation for the study of medicine. (c) A basis for college graduate work leading to the higher degrees. (d) A training for teachers of pharmacy and for food and drug inspection chemists as well as other high positions of the profession.

The curriculum of the first and second years is devoted chiefly to the preparation of the student in the various foundation sciences, and that of the junior and senior to strictly pharmaceutical and cognate subjects, with electives and thesis, for the purpose of allowing the student to specialize for any desired position.

As a pursuit pharmacy has at least three distinct branches, namely, dispensing practice, pharmaceutical manufacture and foreign trade. In each branch there is a large amount of work that can be done only by persons of proper scientific training. This training is best obtained by laboratory work and lecture studies in chemistry, general, analytical and organic and in pharmacy and cognate subjects.

PHARMACY

FRESHMAN YEAR.

First Semester.		Second Semester.	
General Chemistry (1)	4	General Chemistry (Chem. 1)	4
Trigonometry (2)	2	Analytical Geometry	4
Algebra (1)	3	Plant Physiology and Histology (Biol. 10)	4
German	4	German	4
General Botany (Biol. 9)	5	Drill	1
Drill	1		
	19		17

SOPHOMORE YEAR

Organic Chemistry (10)	3	Organic Chemistry (10)	3
Qualitative Analysis (2)	4	Quantitative Analysis (3)	4
German or French	3 or 4	German or French	3 or 4
English (1)	2	English (1)	2
Introductory Pharmacy (1)	5	Official Pharmacy (2)	3
Drill	1	Pharmacy Laboratory (3)	2
		Drill	1
	18 or 19		18 or 19

JUNIOR YEAR.

Inorganic Pharmacy (6)	4	Pharmacognosy (4)	4
Quantitative Analysis (3)	3	Physiology (Biol. 3)	4
French	3	French	3
Physics (1a)	3	Physics (1a)	3
Bacteriology (12)	5	Proximate Organic (4)	4
	18		18

SENIOR YEAR

		Micros. Study of Po. Drugs (5)	2
		Physiological Chemistry (11)	2
Proximate Organic (4)	4	Materia Medica and Therapeutics (8)	4
Pharmaceut. Testing and Drug Assaying (7)	3	Economics (1)	2
Mineralogy (1)	3	Dispensing (9)	1
Economics (1)	2	Elective	3
Elective	4	Toxicology (10)	1
Thesis	2	Thesis	3
	18		18

Art

MRS. MARSHALL.

Upon entering the art department we find ourselves in a suite of spacious studios, occupying the one hundred foot north front of College Hall, and lined with objects of art.

Here are many plaster casts from the antique ,comprising ,among other things, full length figures of the Venus of Milo, the Running Gladiator, and the Winged Victory. There are also portrait busts of Cicero, Sophocles, and other celebrated characters, and many masks of different types and nationalities.

There are many fine reproductions of the Barrie bronzes and other casts of animals, birds, flowers, and fruits. Many of the great styles of architecture and ornament are represented in plaster, from Egyptian down to the Renaissance.

We shall find many photographs from foreign countries, and reproductions of celebrated pictures in engravings and etchings. There is also a fine collection of works on art, suitable for class reading or serious study.

Among the other equipment for work the department has a china kiln of the largest size, in which the china painted by the classes is fired on the premises.

There are full sets of tools for wood carving, which are at the service of students, and an instrument for pricking and applying patterns for embroidery.

If we visit the studios during the class hours we find students working in many branches of art,—some in wood carving and clay modeling, some in painting on china, while in other rooms they may be drawing from the antique, painting in water-color, oil, or pastelle, studying applied design or taking lessons in perspective, or other work connected with the engineering departments.

Lectures on art often take the shape of imaginary tours in the great cities, and through the great galleries of the world, and are illustrated by pictures and stereopticon.

Attention is called to the regulation printed on page 17 regarding the keeping of work suitable for exhibition.

(1) Drawing from the cast, in charcoal, crayon or pen and ink, still life and object drawing, sketching from nature, when the weather will permit. Study of plant forms, with suggestions for their application to design. In object drawing the pupil is required to study artistic grouping and good arrangement of light and shade. Memory and time drawing—blackboard work.

(2) Painting—in oil, water color, or pastelle. No. 1 prerequisite.

(3 **Freehand Drawing for Engineers.**—Perspective as applied to sketching from natural objects, freehand lettering, blackboard dictation, object drawing, with proper shading, freehand drawing of machinery, use of water color in connection with mechanical work, study of achitectural styles, tests for color signals. I and II, 4.

(4) **Drawing From Nature.**—Drawing and painting of plants and animals, intended especially for students in biology. It may be taken in either semester separately. I and II, 2—6.

(5) **Normal Work.**—This is a course in the training of the eye and hand and in the methods of teaching, intended especially for those who may be planning to teach art. Those who take this work will be allowed some opportunity for practice in teaching under the direction of the head of the department. I and II, 4—8.

(6) **Wood Carving and Clay Modeling.**—Tools and clay provided by the department.

(7) **Applied Design.**—Study of color schemes and color harmony, with historic ornament, leading up to practical designing for various handicrafts. Each student will occasionally submit original designs for embroidery, wood-carving, and other decorative work based upon natural forms. Courses 1 and 2 are prerequisite.

(8) **Figure Study.**—A life class open to all who show talent for drawing from the human form. Study of costume.

(9) **Painting on China.**—Students to be admitted to the work in china painting must satisfy the instructor that they have the necessary preparation to undertake the work profitably. China is fired in the studio. Courses 1 and 2 are prerequisite.

(10) **Art Lectures.**—Required of pupils taking certain courses but open to all students who may wish to attend them.

Biology

PROFESSOR COOLEY.

ASSISTANT PROFESSOR SWINGLE.

ASSISTANT PROFESSOR SPAULDING.

The new agricultural building will be completed in the fall of 1908 and the biology department will remodel and occupy the whole of the building formerly used for the experiment station.

In the basement will be a small class room, an herbarium room and rooms for storing chemicals and apparatus. One large room will be devoted to receiving and unpacking apparatus and supplies and for rough storage. The entire west half of the first floor will be made over into

a large laboratory for the use of students. This will be equipped with large heavy tables, individual lockers and apparatus cases as necessary, and will accomodate twenty-five students. The east half of the first floor will be occupied by the office of the department, a private laboratory for the station entomologist and a library.

The laboratories on the second floor accomodate about fifty students and are equipped with heavy tables with drawers. These rooms are supplied with gas and electric light. Individual lockers and cupboards for the convenience of students in bacteriology, physiology and general botany and zoology are in these rooms.

Opening off the bacteriological laboratory are a culture room for transferring bacteria without danger of contamination and an incubator room where an incubator and paraffin bath are maintained at a constant temperature.

A greenhouse attached to the building on the south side contains a laboratory and a small hothouse. This laboratory and greenhouse combined are for the exclusive use of classes in plant physiology and plant pathology and are especially constructed to that end. Both are under glass and are provided with cement floors that plants may be carried from one to the other without suffering change of environment. Opening out of the physiological laboratory is a large dark room, with double doors, equipped for experiments illustrating the action of light and darkness on the behavior and growth of plants.

The greenhouse is attractively furnished with plants, both ornamental and illustrative; and the laboratory has aquaria in which running water keeps algae and other aquatic plants growing the year round.

Among the more important pieces of apparatus available for work in the various branches of botany and zoology are the following: Thirty-four compound microscopes, five of which are equipped with excellent oil immersion lenses of the best makes in this country and Europe. Beside the regularly required lenses attachable to the these microscopes are a fine series for speial purposes, including those made especially for photomicrographic work; a Filar micrometer and several stage and eye-piece micrometers for the accurate measurment of microscopic objects; four dissecting microscopes with ratchet and pinion adjustment of the lenses, of which there is a series with each instrument; twenty-two very serviceable dissection microscopes of less expensive construction; one rotary microtome for rapid and fine work one Minot automatic precision sliding microtome especially constructed for sectioning wood and well adapted for general work; a large supply of dissecting instruments; two paraffin baths with attachments for maintaining a constant temperature; a good working set of stains and other chemicals for histological work in both animal and vegetable tissues; one incubator with constant temperature attachment, serviceable in embroyological and bacteriological work; one large



ZOOLOGICAL COLLECTION.



CIVIL ENGINEERING CLASS.

size eclipse type of autoclave, the most up-to-date and serviceable of any now available; one hot-air sterilizer of the large improved Lautenschlager type; one Koch sterilizer; one Arnold sterilizer; one Ganong Clinostat; one Draper self-recording theremometer; one Draper self-recording hygrometer; six auxonometers; one photosythiscope; six warm stages.

Besides the pieces above listed the department owns a large quantity of general apparatus, glassware and chemicals, sufficient for giving, in a thorough manner, all the sub-courses listed in this department.

It is the purpose of the biological library to furnish the students with full and up-to-date knowledge of all zoological, botanical and bacteriological subjects taught at the college and such special subjects as may be taken up for research work.

Of the larger and more important works are Saccardo's "Sylloge Fungorum" for the identification of fungi; Engler's and Prantl's 'Pflantzenfamilien," covering the entire plant kingdom; DeToni's "Sylloge Algarum" for the algae and the Kew Index and Britton and Brown's "Illustrated Flora of North America," relating to the flowering plants, and most of the more important classic and recent works on plant morphology, physiology and classification and on the various phases of bacteriology. There are also several hundred pamphlets dealing with special lines of botanical work, and a full set of bulletins of the state experiment stations and the U. S. Department of Agriculture, which are rich in research papers on botanical subjects.

To keep up with the most recent discoveries, we receive regularly a number of the best botanical periodicals published in this country and abroad, and we are constantly adding to our library as our special needs require.

The department is well equipped with necessary zoological literature. Special attention has been paid to accumulating titles relating to entomology and physiology, as well as general zoology. Among the more important books may be mentioned the following: Genera Insectorum (complete); Zoological Record, Entomological News (complete); Canadian Entomologist (complete), Zoologische Anzeiger, Anatomischer Anzeiger, Psyche (complete); transactions of the American Entomological Society. Besides these are a large number of books treating of the various branches of zoological science. These, together with a large number of unbound pamphlets, constitute a good working library.

The department has purchased the entomological section of the Concilum Bibliographicum and is a subscriber to the additional cards. This catalogue and one of about 35,000 references, made by the department, are of great service in facilitating the library work of the students in entomology.

A large, well selected, and rapidly growing series of microscopical mounts, including histological preparations of animal and vegetable tis-

sues, bacteria and dissected parts of plants and animals is available for the use of students and is of great value in their instruction.

For preparing lantern slides, prints and other illustrative material for the students, for illustrating theses and research papers and to acquaint the student with photographic methods, the biology department is provided with several good cameras. Among these are a 5x7 camera provided with a Bausch and Lomb make of the Zeiss convertible anastigmatic lense, series VII, a lense for general use, and a Bausch and Lomb photomicrographic outfit, including one special lense and two specially constructed microscope objectives. There are two dark rooms, one exclusively for photographic use and one in connection with the physiological laboratory used for photographic work during vacations and at other times when not in use by students in their experiments with plants. A good supply of chemicals for making the varous developers, etc., is always on hand.

On the third floor, opposite the museum, is a well lighted lecture room which can be quickly darkened for the use of the electric lantern on a raised platform in the rear of the room. Fully one thousand lantern slides are in the department for use in illustrating the lectures. A large part of the Kny series of botanical charts in colors and in black and white, and a series of zoological charts after Leukart are also used with the lectures.

(1) **Invertebrate Zoology.**—Devoted to a study of the invertebrate animals, including their morphology, development, habits, economic or popular interest, and classification. The broad biological principles are brought out and emphasized. The class room work is based on Weysse's "Synoptic Text Book of Zoology." The laboratory exercises include a study of the morphology of types, reference reading and practical work in the classification of the animals. Required of agriculture and general science students except those in the mathematics and physics group. I, 5. Lectures, 3; laboratory, 2. Assistant Professor Spaulding.

(2) **Vertebrate Zoology.**—A continuation of (1), taking up vertebrate (chordate) forms. Required of agriculture and biology students. Elective for those who have taken (1). II, 4. Lectures, 2; laboratory, 2. Assistant Professor Spaulding.

(3) **Animal Physiology and Histology.**—The student is required to prepare for microscopical study a series of tissues taken from the bodies of freshly killed animals and these slides, together with a large series owned by the department, form the basis of an extended study of animal tissues. By a series of lectures and demonstrations, supplemented by reading courses, the student is taught the main facts of animal physiology. Required of agriculture, home science and biology students. Elective for general science students who have taken (1). II, 4. Lectures, 2; laboratory, 2. Assistant Professor Spaulding.

(4) **General Entomology.**—Lectures on the morphology, metamorphoses and classification of insects and a study of the different orders.

Collecting, naming, labeling and arranging in museum form species that are to be found in the vicinity of Bozeman. Required of biology students. Elective for others who have taken (1). I, 4. Lectures, 2; laboratory, 2. Professor Cooley.

(5) **Economic Entomology.**—A briefer account of the structure, metamorphoses and classification of insects, followed by an extended study of the general principles underlying insect depredations, together with an account of the more important insect pests of the garden, orchard and farm in Montana. Required of agriculture students. II, 4. Lectures, 3; laboratory, 1. Professor Cooley.

(6) **Advanced Entomology.**—This course is a continuation of the general entomology course (4), and is made up of reading and conference work and of laboratory exercises. Students in this course will be assigned work best suited to their special requirements. Forestry students will take up a detailed study of the insect pests of the forest, while regular biology students will be assigned more technical subjects. II, 1 to 5. All laboratory work. Professor Cooley.

(7) **Household Economic Entomology.**—Lectures on insect life injurious to food materials, clothing, carpets, draperies, etc. Required of college students in home science. Open to other lady students in the general science courses. II, 2. Lectures. Profesor Cooley.

(9) **General Botany.**—Morphology, anatomy and elementary physiology of plants, including life history studies of all the groups. The fundamental biological principles are here laid down on which all higher botanical studies are based. Required of all science and agriculture students. I, 5. Lectures, 2; laboratory, 3. Assistant Professor Swingle.

(10) **Plant Physiology and Histology.**—Experimental work in the movement, growth, nutrition and reproduction of plants with a microscopical study of the structure involved. Must be preceded by biology (9) and chemistry (1). Required of agriculture and biology students. II, 4. Lecture, 1; laboratory, 3. Assistant Professor Swingle.

(11) **Plant Pathology.**—Classification, morphology and special physiology of parasitic plants, with a detailed study of diseases of Montana plants, and their control. Must be preceded by Biology (9). Required of agronomy and horticulture students. II, 4. Lectures, 1; laboratory, 3. Assistant Professor Swingle.

(12) **Bacteriology.**—A study of the structure, life history and classifications of bacteria, their growth in nutrient media, and methods of bacteriological technique. The relation of bacteria to agriculture, disease, and our daily life is discussed. Must be preceded by Biology (9) or (3) and Chemistry (1). Required of agriculture and home science students. I, 4. Lectures, 1; laboratory, 3. Assistant Professor Swingle.

(13) **Forest Botany.**—A thorough study of types of trees and identification by means of leaves, twigs, flowers, fruits, seedlings, etc. The

ecology of woody plants is treated with especial reference to moisture and altitude best suited for growth. I, 3. Lectures, 1; laboratory, 2. Assistant Professor Swingle.

(14) **Forest Technology.**—Gross anatomy and histology of woody stems with special relation to the strength, beauty and quality of the wood for technical purposes. Tests of the strength of different woods and methods of cutting and finishing are studied experimentally by the students. II, 3. Lectures, 1; laboratory, 2. Assistant Professor Swingle.

(15) **Thesis.**—Students in the biology course in their senior year and seniors from other courses, who have had sufficient previous training in biology, may devote a maximum of five credits per semester in thesis work, under the direction of Professor Cooley or Assistant Professors Swingle or Spaulding.

Chemistry

PROF. COBLEIGH.

MR. HAM.

MR. MOLLET AND ASSISTANTS.

The applications of chemistry to the various phases of agriculture, to engineering and to many modern industries, makes this science an important one in a technical school. The fundamental courses of the science should be thoroughly taught in order that the student may have sufficient training and independence to apply his knowledge to practical operations. If the student is to master the principles of chemistry and at the same time obtain a working and practical knowledge of chemical manipulation, he must have certain facilities at his disposal.

Below is given, somewhat in detail, a description of the equipment and the conveniences provided for the study of chemistry in this institution.

The lecture room, with seating capacity for over one hundred students, has a lecture desk provided with water, gas and electricity, a demonstration balance and a stereopticon for showing the applications of the science. The class room exercises in general and applied chemistry are illustrated by experiments, lantern slides, and in many cases by exhibits of the raw materials and finished products of commercial processes. The lecture room equipment is in an adjoining room, which also serves as a private laboratory.

There are five laboratories equipped for the following lines of work: General chemistry, qualitative and quantitative analysis, organic and food chemistry, physical chemistry, and assaying. All desks are provided with water, gas, electricity, and filter pumps where needed. The hoods in each laboratory are furnished with gas and water connections. In

each there are large steam and air baths, in operation at all times, being connected to the steam heating plant. The building is well ventilated by means of a mehanical draft, and heated by a direct indirect steam system. With some of the classes working in sections the laboratories will accomodate over 150 students.

The store room is stocked with an ample supply of the apparatus and chemicals needed for the various laboratory courses. The student secures what equipment he needs from time to time in addition to that always kept in his desk, from the store keeper, who is on duty at convenient and stated hours. The equipment includes, besides the usual stock of apparatus, much that is designed for special use, such as accurate balances for both quantitative analysis and assaying, standard weights, equipment for calibrating measuring apparatus, polariscopes, Abbe refractometer, oil testers, apparatus for water, air, and gas analysis, combustion furnaces, Hoskin's crucible and muffle furnaces for assaying and for experiments necessitating high temperatures, apparatus for gas density determinations, and Beckman's freezing and boiling point apparatus, and equipment for conductivity measurements, etc.

The department museum occupies a well lighted room in the basement. In this room are stored in cabinets, and glass exhibit cases, the collections illustrating chemical industries of various kinds, and the mineralogical and geological specimens. The mineral collection is quite extensive. It includes a valuable private collection purchased by the college some years ago. To this was added a part of the Montana mineral exhibit at Chicago in 1893, and large additions have been made from time to time through exchanges and purchases. The collection is thoroughly representative and forms an important adjunct to the chemical department.

The chemical library and office is located on the first floor and contains full sets of the American Journal of Science, Journal of the American Chemical Society, Journal of the (London) Chemical Society, Berzelius Jahresbericht, Bericht der deutschen Chemischen Gesellschaft, and Fresenius Zeitschrift fur Analytische Chemie. There are also partial sets of Chemical News, and the Analyst. Besides these the library contains many standard reference works and the recent text books. There are also index volumes and card catalogues to facilitate more ready reference to the literature.

(1) **General Chemistry.**—Two lectures, one recitation and one 2½ hour laboratory period per week throughout the year on the fundamental laws of chemistry, the history, occurrence, preparation and properties of the common elements and their compounds. Text books, Newth's Inorganic Chemistry, Lenher's Laboratory Manual. I and II, 8.

(2) **Qualitative Analysis.**—Lectures and recitations two hours per week on the theory and practice of qualitative analysis, the properties of solutions, laws of ionization, and mass action as applied to analytical

chemistry. Laboratory practice two afternoons per week in the analysis of simple salts, complex mixtures, ores and minerals. Text books, Qualitative Analysis by Dennis and Whittelsey; Electrolytic Dissociation Theory by Talbot and Blanchard. I, 4.

(3) **Quantitative Analysis.**—Two lectures and recitations per week during the second semester of the sophomore year and one lecture during the first semester of the junior year. The class room work includes discussions on the theory and technique of the laboratory methods and chemical calculations. Five hours of laboratory work per week during first semester of the course and seven and one half hours during the second semester. The analyses required include the following: Magnesium sulphate, potassium alum, iron ammonium alum, iron ore, limestone, clay or slag, zinc, lead, copper, manganese, arsenic, antimony, and nickel ores, alkalimetry, acidmetry, coal and flue gas. Text books, Miller's Notes on Quantitative Analysis for Mining Engineers; Treadwell's Quantitative Analysis, and Miller's Calculations of Analytical Chemistry. II and I, 8.

(4) **Proximate Organic Analysis.**—This course is designed to meet the needs of students intending to specialize in agricultural chemistry, and includes lectures, recitations, and laboratory work. The following analyses are included in the course: Feeding stuffs and cereals, fertilizers, soils, sugars, milk, butter, oils, alcohol, glycerol, formaldehyde, and the detection of adulterations in foods. Text book, Proximate Organic Analysis by Sherman. I, II and I, 12.

(5) **Organic Chemistry.**—An elementary course designed to make the student familiar with the principles of organic chemistry and with the more important compounds of both aliphatic and aromatic series. Remsen's Organic Chemistry is used in the class room, and the laboratory work is based on the Holleman-Walker Laboratory Manual, and Gaetterman's Practical Methods of Organic Chemistry. I and II, 6.

(6) **Physical Chemistry.**—A course in theoretical chemistry consisting of lectures, recitations, assigned problems, and laboratory work. The class room discussions include the following topics: The gas laws, thermodynamics, solutions, chemical mechanics, equilibrium in electrolytes, and electro-chemistry. The laboratory work includes vapor density determinations, freezing point, boiling point, and conductivity methods, etc. Text books, Morgan's Physical Chemistry for Electrical Engineers; Ostwald's Physico-Chemical Measurements. I and II, 6.

(7) **Agricultural Chemistry.**—This course is designed especially to meet the needs of students in the four year courses in agriculture. Three class room exercises per week are held for the purpose of studying the chemistry of the following topics of importance to an agriculturist: The soil, manures and fertilizers, constituents of plants, animal products, foods and feeding, milk and milk products. Text books, Ingle's Manual of Agricultural Chemistry. Laboratory work three afternoons per week, mak-

ing analyses which include the following: Magnesium sulphate, potassium alum, iron ammonium alum, limestone, feldspar or clay, soil, cereal or feeding material, fertilizer, milk and butter. Text book, Lincoln and Walton's Quantitative Analysis for Students of Agriculture. II, 6.

(8) **Food Chemistry.**—Arranged for students in the junior year of the home science course. Class room discussions on the chemical composition of different foods, and their functions, the preservation and adulteration of foods, supplemented with appropriate laboratory exercises designed to emphasize the class work. Text book, Sanitary and Applied Chemistry by Bailey. II, 3.

(9) **Industrial Chemistry.**—Lectures, recitations, and assigned reading on the industrial applications of chemistry. The topics considered will depend, to a certain degree, upon the purposes of the students who take the course. In general it will include fuels, refractory materials, limes, mortars, and cements, building stones, timber and its preservation, the properties of iron and steel, the treatment of the ores of lead, gold, silver, and copper, illuminating gas, explosives, etc. I and II, 6.

(10) **Water and Air Analysis.**—A course designed for students in sanitary engineering. The sanitary analysis of water and air, with discussions on the proper interpretations of analytical results. Text books, Mason's Water Supply, and Richard and Woodman's Air, Water and Food. II, 2.

(11) **Mineralogy.**—Blowpipe analysis, elementary crystallography, and determinative mineralogy. Lectures and laboratory work. Text book, Moses and Parson's Mineralogy. I, 3.

(12) **Assaying.**—Conferences, recitations, and laboratory work. Testing the purity and reducing power of fluxes, fire assay for lead, gold, and silver ores, and gold and silver bullion, chlorination assay, cyanide and amalgamation tests. Text book, Fire Assaying by Fulton. II, 4.

(13) **Seminar, Abstracting.**—In order to develop in the student a habit of careful reading, each student will be required to make abstracts of articles on assigned subjects from the leading journals, and present them at weekly meetings of the students and department instructors, where the topics are freely discussed. They are thus kept in touch with the progress of the science. I and II, 1.

(14) **Thesis.**—Students in the chemistry course are required in the senior year to prepare a graduating thesis on some subject which will involve considerable laboratory work and as much originality as possible. I and II, 4

English

PROF. BREWER.

The library has abundant equipment for all the work offered in English. There are complete standard texts of practically all the authors referred to in any of the courses. Besides these there is a fair supply of biographical, critical and historical works, sufficient for ordinary reference use. The library equipment is complete enough so that thus far students have been able to do the reading assigned without the necessity of purchasing many books.

Though many classic novels are to be found on the shelves, no effort has been made in the college library to provide current English fiction.

In the courses in English, written work plays an important part. That this work may be kept up to a proper grade, it is announced here that in college English work no paper will receive any credit that shows notable carelessness or ignorance in elementary matters of punctuation, grammar, rhetoric, or in the spelling of common words.

(1) **English Composition.**—This course is required of all freshmen. The course is almost altogether practice in various types of prose composition, narration, description, exposition, criticism, and argumentation. The class meets ordinarily once a week. The instructor from time to time meets each student for private conference about his work. I and 2, 4.

(2) **Expository Composition.**—This is a course in expository writing for those students who are specializing in other subjects. Papers not extremely technical, prepared for work in other courses, may also be handed in as part of the work of this course. I and II, 4.

(3) **Advanced Composition.**—This is an advanced course for those who wish to study composition as a fine art. It will include a study of the historical development of English prose style and such other work as may suit the taste or needs of those who elect the course. I and II, 4.

(10) **English Literature.**—A reading course in English literature including many of the more important authors from Chaucer to the present day. A large amount of reading is required and more recommended. Written reports on the reading are frequently required. A part of the class room time may be given to critical reading of English masterpieces. I and II, 4.

(11) **English Essayists of the Nineteenth Century.**—A study of the more important essayists from Charles Lamb to R. L. Stevenson. I and II, 4.

(12) **Shakespeare.**—A careful reading of three plays in the class room, and outside reading in other plays of the period. II, 4.

(13) **Victorian Poetry.**—A study of the poetry of the Victorian period, with special reference to the work of Alfred Tennyson, Robert Browning, and Mathew Arnold.

ENGINEERING SOCIETY.



HAMILTONIAN SOCIETY.

Geology

PROF. COBLEIGH.

The vicinity of Bozeman is an excellent locality for the student of geology. It affords many opportunities for studying the action of forces now in operation and also for observing the effects these forces have produced in the past. The geology of this locality has been worked out by the U. S. geological survey and the survey publications are in the college library.

The college museum contains excellent collections of mineral, rocks, and fossils, which are used for class room study. A set of lantern slides is used for illustrating the lectures.

(1) **Geology.**—Lecture, recitations, and assigned reading on dynamical and structural geology. Text book, Scott's Introduction to Geology. II, 2.

History

MISS BREWER.

The department has a set of McCoun's historical charts of the United States and two sets of historical geography charts of Europe by the same author; Johnson's series of maps of ancient geography; ten of Bretschneider's maps of medieval Europe; and a set of maps of the modern world.

The library contains the laboratory of the historical department, but a catalogue of the histories would be too voluminous to include here. In Greek and Roman history, besides the standard narrative works, there are translations of the best source material for this period. For English history the library is well equipped with general works and has source material including Colby, Lee, and the University of Pennsylvania collection. Evelyn's Dairy, a file of "The Gentleman's Magazine," etc.

Naturally the works on the United States history are the most numerous. The standard general histories, as well as works on limited periods or regions, and the best biographies of American statesmen, are in the library. The reports of the American Historical Association, and the Congressional Records, come to the library. There are also many contemporary records, among which are the Old South Leaflets, Hart's American History Told by Contemporaries; the complete works of Jefferson, Hamilton and other statesmen, and the Jesuit Relations.

(1) **European History.**—It is taken for granted that the student has had a preparatory course in general history, with some such text as Myers or West. In this course special attention is paid to English history, and the student's work is supplemented by lectures on the development of continental Europe. Cheyney's History of England and Kendal's

Source Book are texts in the hands of the class, and special topics with library references are occasionally assigned. I and II, 4.

(2) **Medieval History.**—The student is supposed to have had courses which have given him knowledge of the great epochs in history and their relations to each other. Therefore, in this course he will take up the thorough study of one period. He will be encouraged to form his own opinions by the use of such historical sources of this period as are available in translations. In this connection the student will be given practice in application of the fundamental rules used in testing the value of historical material. I and II, 6.

(5) **American History.**—This is a course in United States history covering the period of constitutional development and with special reference to that development. The use of the library rather than any text book is required in this course, and the student is expected to spend about one-fourth of the time in the preparation of a paper on some selected subject. Course 2 should precede this course. I and II, 6.

(6) **Thesis.**—For reseach work in his senior year the student is allowed to select any historical subject which he is qualified to investigate; and for which some material is available either in translation or original.

Home Science

MISS HARKINS.
MISS BALLINGER.
MISS LUCILE BREWER.

The third floor of the new agricultural building will be occupied by the home science department. In the north end are two kitchens, one on either side of the hall. One, 34x26 feet, has two coal ranges, several electric stoves and desks for 16 students. The other, 27x26 feet, has one coal range and fifteen desks fitted with individual gas stoves. All tables are well supplied with cooking utensils. Off from the east kitchen is a model dining room and beyond it the department office. With the other kitchen is a student lunch room, 25x23 feet, connected by folding doors with the class room. There are also store rooms, pantries and cold storage rooms.

In the south end of the building is a large sewing room, 47x31 feet, with a class room, 31x16 feet, two small fitting rooms, and cases for the work of 100 students. Connected with these are an office, a class room, model bed room, and reception room. The department has eight sewing machines of various makes, two electric irons, cases for exhibition work, and large and small work tables.

(1) **General Cookery.**—The object of this course is to teach plain cooking,—breads, meats, soups, salads, vegetables, and simple desserts. Special attention is given to table decoration, and serving of meals. Two

practice hours and one demonstration each week. Required of all freshman girls. I and II, 2.

(2) **Food Principles.**—A study of the classification of foods with regard to composition, digestibility and preparation. Lectures on marketing and care of supplies. Required of all freshman girls in home science course. II, 2.

(3) **Economic Uses of Food.**—Special attention is given to the economic side of the food question. Required of sophomore girls in home science course. One lecture and two laboratory periods each week. I and II, 6.

(4) **Home Architecture and Sanitation.**—The surroundings, situation and plan of the house, heating, lighting, plumbing, and drainage. Two lecture periods. Requred of all junor girls in home science course. I, 2.

(5) **Home Nursing and Invalid Cookery.**—Required of all junior girls in home science course. II, 2.

(6) **Final Demonstration.**—Each student prepares a breakfast or luncheon for public demonstration. Required of senior girls in home science course. I and II, 2.

(7) **Journal Meetings.**—Topics relating to home science are assigned and discussed. Required of senior girls in home science. I and II, 3.

(11) **Sample Stitches.**—Plain and machine sewing. At least two aprons, four pieces of underwear, two shirt waists, and a house dress must be completed. This work is requiired of freshmen in home science course. I and II, 4.

(12) **Garment Making.**—At least three garments, a shirt waist and a dress must be completed. Students who took sewing (11) will be expected to make more elaborate garments. Required of all sophomore girls. I and II, 2.

(13) **Sewing, Drafting, Cutting and Fitting, and Dress Making.**—Required of junior girls in home science. I, 1; II, 2.

(14) **Art Needle Work.**—Required of senior girls in home science course. I, 2.

(15) **Dressmaking.**—During this semester the graduating dress must be made. II, 2.

(20) **Thesis.**

Latin

PROF. BREWER.

MISS BREWER.

(1) **Virgil.**—Five books of the Aeneid are read. Metrical reading of Latin is required constantly. The students are encouraged to make metrical translations and paraphrases. I and II, 8. Prof. Brewer.

(2) **Livy and Horace.**—The special aim in this year's work, as in the previous course, is to enable the student to acquire facility in reading and a literary appreciation of the authors read. I and II, 4. Prof. Brewer.

Mathematics

PROF. TALLMAN.

MISS BULL.

The students in this department have access to the following journals: American Journal of Mathematics (complete set); Annals of Mathematics (from 1900); Bulletin of American Mathematical Society (1898 to date); and Transactions of American Mathematical Society (1898 to date), also about 200 volumes of recent treatises on mathematics. It may also be mentioned that our library is especially well equipped in treatises and journals of applied mathematics found in the libraries of the engineering and physics departments.

(1) **Algebra.**—Beginning with a review of radicals and quadratic equations, the course includes progressions, arrangements and groups, binomial theorem, theory of limits, undetermined co-efficients, logarithms, and an introduction to the theory of equations. I, 3.

(2) **Plane Trigonometry.**—For engineering and science students. I, 2.

(2a) **Plane Trigonometry and Logarithms.**—For agricultural and home science students. I, 3.

(3) **Analytical Geometry.**—Straight line and conic sections, with an introduction to the geometry of three dimensions. II, 4.

(4) **Calculus.**—Both differential and integral, with applications to as many practical problems as possible. I and II, 10.

(5) **Method of Least Squares.**—I, 2.

(6) **Theoretical Astronomy.**—Integration of equations of motion, computation of orbits and ephemerides. This course should be preceded by course (5) in physics and must be preceded by course (4) in mathematics. II, 3.

(10) **Differential Equations.**—Ordinary and partial differential equations with geometrical and mechanical applications. I and II, 6.

(11) **Partial Differential Equations of Mathematics - Physics.**—This course will be based on Weber's "Die Partiellen Differential Gleichungen der Mathematischen Physik," and Byerly's "Spherical Harmonics." A great many applications to concrete problems will be made throughout the course. I and II, 6.

(12) **Newtonian Potential.**—Lectures on the theory of potential, with an introduction to spherical harmonics. I and II, 4.

(13) **Algebra (Advanced).**—This course will be an extension of course (1), and will contain diiscussion of complex numbers, theory of algebrais functions, etc. Care will be taken to show the practical application of each subject as the work advances; that is, such subjects as the connection between complex numbers and alternating currents, etc., will be fully explained. I and II, 6.

(14) **Analytical Geometry (Advanced).**—This course is a continuation of course (3). As the time given in course (3) for geometry of three dimensions is very limited it will receive considerable attention in this course. I and II, 6.

(15) **Thesis.**—Students specializing in mathematics are required to present a thesis on some chosen subject. The subject must be chosen and approved not later than November 15 of the senior year. A great deal of work in this line is desired, as it is believed there is no better way of developing a habit of independent thought.

(16) **Mathematico-Physical Seminar.**—During the year students and members of the faculty, especially interested in these subjects, will meet once a week to review articles of interest in the current magazines, to present from time to time results of original research which is being carried on, etc. Students in the mathematical group are required to attend.

Only a selection of courses (10) to (14) will be given each year, those being chosen for which most students apply. The special object of our work here is to make the courses in applied mathematics complete, and the work in pure mathematics will have as its object the laying of a good foundation for the more advanced work in applied mathematics. Those desiring to do work which is not offered in the above courses may consult the professor in charge of the department.

Modern Languages

PROF. CURRIER.
MRS. HALL.

The modern language department is well represented in the college library. The list includes the standard works in German and French literature in the original, as well as complete translations of the more important writers.

Many works of historical and critical nature and a number of standard lexicons may also be consulted. Several foreign language periodicals are at the disposal of students.

(1) **French.**—The study of French is begun in the freshman year, and the first year's work includes a thorough study of the elements of grammar, careful reading, with translation of 300 pages of easy French, composition, practice in pronounciation and oral reading. Fair facility in sight reading is expected at the close of the year. I and II, 8.

(2) **French.**—In the sophomore year, in addition to easy texts and further study of grammar and composition, the classics, prose and poetry will be read, and also some scientific French, thus cultivating in the student an appreciation of the best foreign literature. The chief aim of the course is the acquisition of practical reading knowledge. I and II, 6.

(3) **French.**—An elective course in the French classic drama and nineteenth century fiction is offered to juniors and seniors. I and II, 6.

(10) **German.**—This course is open to college students who have not had high school or preparatory German. The work of the first year includes careful study of the elements of grammar, composition, pronounciation, conversation, the reading of easy texts, and sight reading. I and II, 8.

(11) **German.**—A continuation of the above course. The work consists largely of reading of a practical nature, with some introduction to the classics. Further attention will be paid to grammar and composition. If requested, scientific German will be read. I and II, 8.

(12) **German.**—The freshman work in German is a continuation of the course offered in the preparatory department, and can be taken only by students who have had two years of German previously. The classics will be studied; also, scientific texts if desired, and some attention will be given to composition and conversation. I and II, 8.

(13) **German.**—An elective course offered to those who have completed course 11 or 12. It consists chiefly of advanced reading of a practical, scientific or literary character, as the needs of the students electing it may dictate. I and II, 4.

Pharmacy.

MR. MOLLETT.

For the description of the work in pharmacy see the numbered paragraphs under title School of Pharmacy, in the later pages of this catalogue.

Philosophy and Economics

PRESIDENT HAMILTON.

(1) **Psychology.**—This course presents a general view of modern psychology and is required of all general science students. It gives a practical exposition of the materials and methods of psychological investigation. The lectures are accompanied by class demonstrations. Attention is given to such topics as the growth of the central nervous system, the nature of consciousness, sensory and motory training, the higher intellectual faculties, and the will. So fas as possible the work is made practical and concrete. I, 3.

(2) **Ethics.**—The work in ethics includes a study of the evolution of conduct, moral standards, the social and industrial life, the development and trend of ethical thought and an examination of utilitarianism. Required of general science students. II, 3.

(3) **Economics.**—This course consists of a study of such questions as land, capital, labor, money, coinage, banking, rent, interest, wages, and taxation. The most important questions in economics of the present time are considered. Among these may be mentioned trusts, labor organizations, government ownership of public utilities, co-operation, recent currency legislation, and the single tax. Required of science students. I and II, 4.

(4) **International Law.**—Woolsey's text book is used, but is supplemented by lectures and library work. In addition to the study of the principles of international law, an examination is made of treaties and the findings of international congresses. A practical study is made of the important questions in which our own government is especially interested, such as the Monroe Doctrine, the Eastern question, international arbitration, etc. Elective, II, 3.

Physics

PROF. COBLEIGH.

MR. HAM.

The science of physics is fundamental to many of the technical studies taught in the college. Therefore the chief purpose of the following physics courses is to provide a thorough training in the science itself and in the use of the scientific method of thought, to the end that the student may have an adequate preparation for the study of the technical subjects in agriculture and engineering which are based on physical principles. The applications of the science are taught in so far as they do not interfere with the main purpose stated above.

The facilities at the disposal of the physics department are described below somewhat in detail.

The lecture room is located in the basement of the chemistry and physics building. The lecture desk is supplied with gas and both alternating and direct current circuits. A projection lantern is permanently set up and is used constantly to illustrate the class room exercises. A large collection of lantern slides has been prepared, which cover the whole subject of physics. The apparatus for lecture demonstration has been carefully selected and is sufficiently complete for giving experimental illustrations of all the principles of the science that are usually included in college courses.

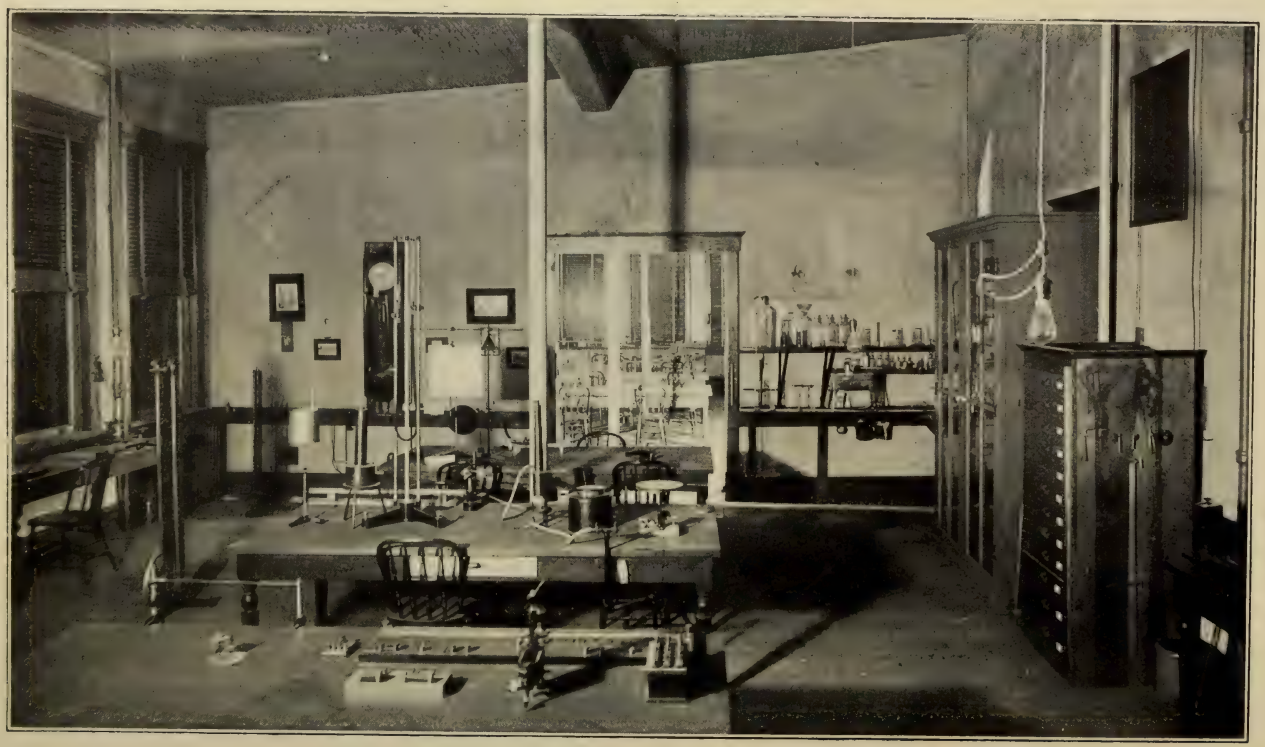
For laboratory instruction three well lighted and conveniently furnished rooms are provided on the second floor of the building.

One of these rooms is equipped for electrical measurements and is wired with both alternating and direct current circuits, conveniently arranged for experimental purposes. The galvanometers are permanently located in convenient positions. The following forms are available: tangent, astatic, Thompson, differential, Northrup, and seven forms of the D'Arsonval type, including two with ballistic suspensions. In addition to the above equipment the following instruments are used in the various experiments taught, viz: magnetometer, standard resistances and condensers, Carhart-Clark cells, wire and box forms of the Wheatstone bridge, Carey-Foster bridge, Callendar and Griffith's bridge, rheometer, electrodynamometer, ammeters, volt-meters, Leeds' potentiometer, platinum thermometer, thermocouples, earth inductor, standard solenoid, and rings of iron wound with wire for experiments in magnetization and hysteresis.

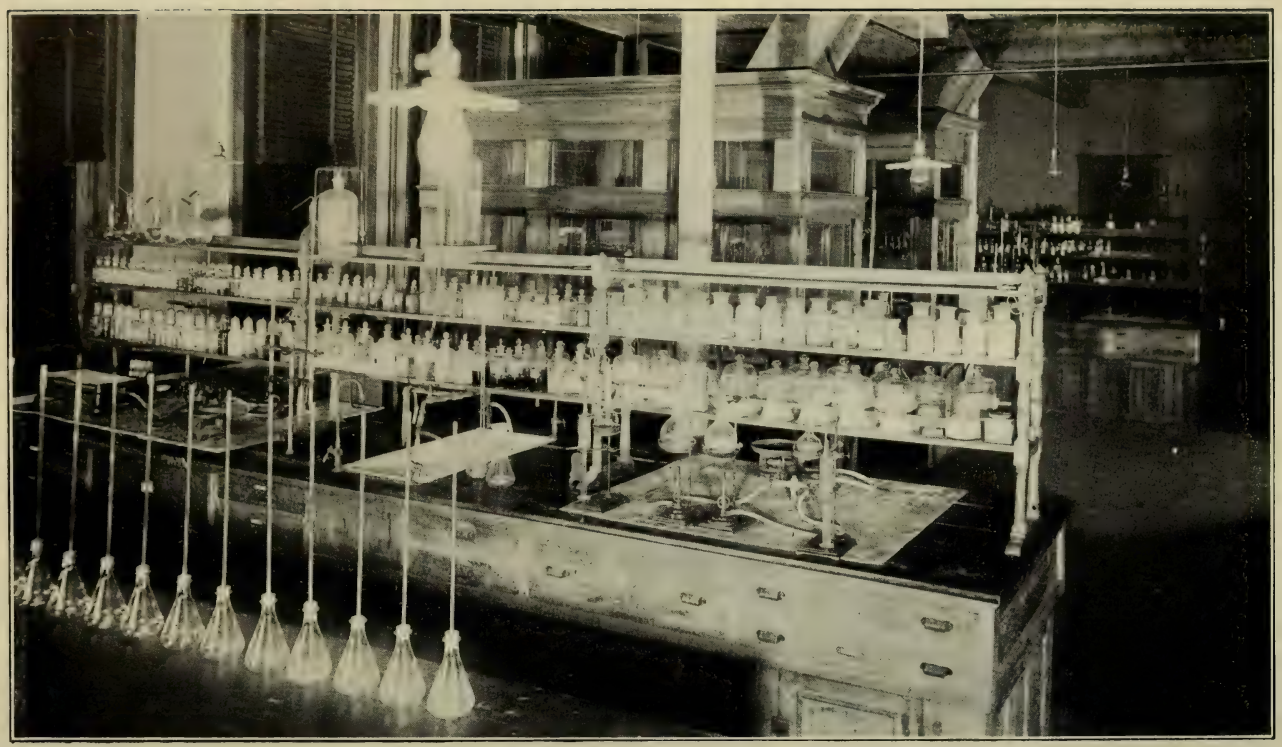
The second laboratory is furnished and equipped for teaching mechanics and heat. The equipment includes the following:: micrometer and vernier gauges, spherometer, cathetometer, balances and weights, hydrometers, Atwood's machine, Young's modulus apparatus, torsion apparatus, torsion pendulums, apparatus for resolution and composition of forces, impact, harmonic motion, principle of moments, centrifugal force, and surface tension; simple and Kater's pendulums, a laboratory clock, thermometers, air thermometer, calorimeters, expansion apparatus, hygrometers, Searles' mechanical equivalent of heat apparatus.

The third laboratory is used for the study of light and sound and also for the elementary classes in the preparatory schools. The equipment for teaching light and sound includes the following: a photometer, two spectrometers, spectroscope, mirrors, prisms, lenses, diffraction gratings, optical bench, Fresnel mirror and bi-prism, apparatus for polarized light, microscope, telescopes, and an Abbe refractometer, sonometers, Kundt's tubes, siren, Lissajous apparatus, and Helmholtz resonators.

For the study of radioactivity and allied phenomena, there is a large



PHYSICS LABORATORY.



CHEMISTRY LABORATORY.

induction coil, a variety of Crookes' and X-ray tubes, Wilson electroscope, radium compounds, and other radio-active material.

The physics library is located in one of the laboratories for students' use. It contains many of the best text books and general works on physics, and the current numbers of the Philosophical Magazine, the Physical Review, Science Abstracts, Section A, and School Science and Mathematics.

(1a) **General Descriptive Physics.**—Two lectures and laboratory work two and one-half or five hours per week in mechanics, heat, electricity, sound and light. Physics (1a) is a prescribed study in the courses in agriculture, biology, chemistry, home science, and history-literature. Mathematics (2) is prerequisite. Text books, Physics, by Mann & Twiss; Laboratory Course, by Sabine; Laboratory Physics, by Miller. I and II, 6 or 8.

(1) **General Physics.**—Lectures, recitations, and assigned problems, three hours per week throughout the year on mechanics, heat, magnetism, and electricity. This course is more mathematical and technical than physics (1a) and is particularly designed to meet the needs of students in engineering and the science students in the mathematics-physics course. Students who have not completed the calculus, mathematics (4), are required to take it during the same year that physics (1) is taken. Text book, General Physics, by Hastings & Beach. I and II, 6.

(2) **Physical Measurements.**—A laboratory course designed to supplement physics (1). It is strictly quantitative and is given for the purpose of providing laboratory illustrations of fundamental principles of the science and to offer a training in making measurements of precision. Text books, Mechaniics, Molecular Physics and Heat, by Millikan; Laboratory Physics, by Miller. I and II, 4.

(3) **Light and Sound.**—Lectures and recitations two hours per week on wave motion, the theory of light in its application to familiar optical phenomena and to optical instruments and the phenomena and laws of sound. Prerequisites, physics (1) and (2). Text book, General Physics, by Hastings & Beach. II, 2.

(4) **Physical Measurements.**—A laboratory course in light and sound to supplement physics (3). II, 2.

(5) **Electricity and Magnetism.**—Lectures, recitations and problems, two hours per week on the mathematical theory of selected portions of electricty and magnetism, electrical units and exact methods of measuring electrical quantities. Physics (1) and (2) are prerequisite. I, 2.

(6) **Electrical Measurements.**—A laboratory course supplementing course (5). It consists of exact measurements of resistance, electromotive force current, capacity, and self-induction, calibration of commencial measuring instruments, insulation tests, battery testing, and magnetic

measurements, including determination of the permeability and hysteresis of samples of iron. Requirements are the same as for course (5). I, 2.

(7) **Advanced Physics.**—Physics (7) is primarily a laboratory course and is offered as an elective to science and engineering students. Conferences and assigned reading are essential features of the course. A more complete study of the precision of measurements will be made than was attempted in physics (2) and a precision discussion will be a required portion of each laboratory report.

There are four separate parts to this course from which the work desired may be selected.

(a) **Heat.**—A study of exact methods of thermometry, pyrometry, calorimetry and determination of the mechanical equivalent of heat. Physics (1 and 2) are prerequisite. Not offered in 1908-9. I or II, 3.

(b) **Light and Radioactivity.**—Conferences, assigned reading and a series of standard laboratory experiments to illustrate diffraction, interference and polarization of light, spectroscopy, photometry, conduction of electricity through gases, and the phenomena of radioactivity. Physics (3 and 4) are prerequisite. Not offered in 1908-9. II, 3.

(c) **Electricity and Magnetism.**—This course will be arranged to suit the needs and purposes of individual students. It is offered as an elective in the science and electrical engineering courses to those who wish to continue the subject beyond the requirements of physics (5 and 6). I or II, 3.

(d) **Manipulation and Construction of Apparatus.**—This is primarily a course in processes useful in the laboratory and includes glass blowing, cutting, grinding, and polishing, preparations of fibres for suspensions, silvering glass, purifying mercury and photography, including copying, printing and lantern-slide making. Practice is given in the construction, and setting up of apparatus suitable for both elementary and college courses in physics. In this connection there will be conferences and assigned reading on the more recent methods of teaching high school and college physics. Physics (1, 2, 3 and 4) are prerequisite. I or II, 3.

(8) **Thesis.**—Students in the mathematics-physics group who elect physics as their major subject, are required in the senior year to prepare a graduating thesis on some subject which will involve considerable laboratory work and as much originality as possible.

Political and Social Science

PROF. BREWER.

For these subjects the library has a fair supply of the best reference books, and material is available also from the best current periodicals, from bound sets of several magazines, and from the government reports, both state and national.

(1) **Constitution of the United States.**—One semester is given to the study of Bryce's American Commonwealth. The aim of the course will be to give a clear idea of the present day working of our government, and the problems that confront it; and to study intelligently contemporary questions of public life. II, 2.

(2) **Sociology.**—The origin and history of human society, the various social theories and the laws of human intercourse are treated. Attention is given to such practical subjects as the government of cities, settlement work, the enrichment of country life, and charity work. Elective, I, 3.

Public Speaking.

MRS HALL.

(1) **Public Speaking.**—Two hours a week throughout the year are devoted to the study of vocal expression and practical public speaking. A few recitation periods are given to a review of parliamentary law as a practical aid to all platform work.

Original material is required in extemporaneous speeches, debate and formal address.

The principles of artistic interpretation and platform oratory are developed by the study and presentation of literary masterpieces. In addition to this required class room work, students receive individual training from the instructor in public speaking and intercollegiate debates, oratorical contests, dramatic recitals and plays. I and II, 2.

School of Music.

FACULTY.

F. ARTHUR OLIVER, Director.*
Teacher of Piano and Harmony.

MISS ARABELLE U. BARNES, Acting Director 1907-08.
Teacher of Piano and Harmony.

MISS REGINA BARNES.
Instructor in Piano Department.

MISS PHYLLIS P. WOLFE.
Instructor in Vocal Department.

GEORGE W. HEY,
Instructor in Violin Department.

ADVANTAGES OF COLLEGE INSTRUCTION.

The advantages of college over private instruction are very numerous and quite obvious to anyone giving the matter serious thought. When a student is seeking the services of a private teacher he must form his judgment as best he can on that person's fitness for his vocation, while it is certain that the teachers of a successful college, are selected mainly on account of their ability, as it would not be in the best interests of such an institution to sacrifice its reputation by employing other than good teachers. Again, the stimulating atmosphere of a music school is another distinct advantage over private instruction.

The music departments are organized for a four-fold purpose:

1. To combine musical and literary studies as a broad basis for regular collegiate instruction.
2. To use the art of music as a means of intellectual, asthetic and moral culture.
3. To teach all branches of music to special and general students.
4. To educate teachers of music.

DEPARTMENTS OF INSTRUCTION.

I. Course for the Pianoforte.
II. Course for the Voice.
III. Course for the Violin.
IV. Course for Harmony, Counterpoint, Analysis, and History of Music.
V. Chorus and Orchestral Instruction.

* On leave of absence in Europe, 1907-8.

No time limit can be designated for the satisfactory completion of any course on account of differences in degree of musical ability; much also depends on the preparation made and upon the amount of time and careful attention the student can devote to the pursuit of a chosen study.

Students who present themselves as candidates for graduation, must give evidence of requisite musical talent and capacity. Each student must give, during the last year of study, at least one public recital, in addition to the final performance at the commencement concert. Students in their graduating year are required to take two private lessons a week. To prepare for graduation, it is necessary that resident students should study with teachers of the college for at least two years. For graduation two years work in harmony will be required and one year in the history of music.

In the piano course, special attention is paid to excellence of technique, acuracy in study, touch and phrasing, use of the pedal, balance of tone between melody and accompaniment and in part playing, playing at sight, and from memory.

The study of music has recently been placed upon an equality with other elective studies in the general science course and a limited number of credits may be counted toward a degree. Diplomas will be granted to students who have done satisfactory work and passed the required examinations.

PIANO DEPARTMENT.

FIRST GRADE.

Fundamental technique, selections from the five finger exercises of Biehl, Vogt, and Mason. All minor scales, four octaves, hands separately; triads in all minor keys; Matthews' graded courses; Duvernoy op. 176; Lemoine op. 37 Bk. I, selections from easy sonatinas and selected pieces.

SECOND GRADE.

Five-finger exercises, transposed in all minor keys, major and minor scales, hands together, legato and staccato. Major and minor chords in triad and four note form, all with inversions, solid and broken. Czerny-Germer studies, Vol. 1, first part; Koehler studies, op. 50; studies by Franklin Taylor and other elementary studies. Clementi and Kuhlau, Sonatinas; Bach, Twelve Little Preludes. Suitable pieces will be selected by the instructor.

THIRD GRADE.

Five-finger exercises continued; major and minor scales, hands together, parallel and contrary motion in quarter, eighth and sixteenth notes. Triads and four-note form chords, with different touches; also the dominant seventh chords. Germer studies, Bk. II; Heller studies;

Duvernoy, op. 120; studies by Franklin Taylor; Bach, Two Voice Inventions. Sonatinas and sonatas, and selected pieces from the classics.

FOURTH GRADE.

Daily technique studies; all major and minor scales in octaves, tenths, sixths and thirds; and also in various rhythmic forms. Triads and four-note form chords; chords of the diminished seventh with inversions. Arpeggios formed on the major and minor chords, on the dominant seventh and on the diminished seventh, with their inversions. Octave studies; Heller studies, advanced grades. Hassert op. 50, Vol. I and II; Clementi, preludes and exercises; Bach, preludes and fugues; Carmer-Buelow studies; Loew octave studies; Sonatas by Beethoven, Haydn, Mozart, Selections by Bach, Mendelssohn, Schubert, Schuman, Liszt, Chopin, Grieg, and others.

FIFTH GRADE

Advanced technique studies and Pischna exercises. All major and minor scales in octaves, tenths, sixths and thirds; in crescendos and diminuendos; two notes against three; three notes against four; scales in double thirds and sixths. All chord forms, solid and broken. Arpeggios formed on all major and minor chords, also on dominant seventh and diminished seventh thirds with their inversions; octaves with any variety of touch required. Bach, Well Tempered Clavichord; Clementi, Gradus ad Parnassum; Moscheles, op. 70, and selected studies by Chopin, Henselt, Haberbier, and Liszt; Kulak, octave studies, Bk. II; Sonatas; Concertos by Beethoven, Mozart, Mendelssohn and others. Miscellaneous classics and selections from modern composerss.

TUITION.

(Payable in Advance)

WITH MR. OLIVER or

MISS BARNES

For one forty-five minute lesson per week, for one semester.....$26.00
Two half-hour lessons per week, for one semester 35.00

WITH MISS REGINA BARNES.

One forty-five minute lesson per week, for one semester.....$18.00
Two half-hour lessons per week, for one semester 26.00

Piano rent.—One hour each day, 30 cents per week.

Regulations.—No reductions will be made for temporary absence from lessons, or for lessons discontinued. Lessons missed by the teacher will be made up at the mutual convenience of teacher and pupil.

The department is closed on the college and national holidays. Lessons falling on these days will not be made up.

HARMONY AND HISTORY.

For the two years' work required for graduation, Jadassohn"s and Banister's Manuals of Harmony are used. A thorough drill is also given in notation—notes and rests, the staffs, clefs and ordinary musical signs; intervals, time, scales, transposition; and definition of musical terms. Students are trained to play cadences, sequences nd modulations upon the piano. Matthews' Popular History of Music will be used for one year.

Fees.—$15.00 for the entire academic year, (one lesson a week).

VOCAL DEPARTMENT.

The purpose of this department is to equip students for teaching and public singing. The solid foundation is laid by means of the Italian method. Italian sounds are used from the beginning as more conducive to free and natural tone production. The student is trained to a right appreciation of this and to a comprehension of breath control and direction, as the only sure guides to success.

Candidates for graduation must have completed a high school course or its equivalent, four years' voice work, one year each of Harmony, History of Music, Solfeggii and Normal Methods, must have some knowledge of modern languages and be able to play accompaniments.

The final examination shall consist of the singing from memory of an aria in a foreign language with not over two weeks preparation, in addition to which the student shall give at least one recital and take part in the graduating program.

Technique studies and songs of the four years course are carefully graded and selected to meet the needs of the individual student. Some of the more important authors and composers are the following: Panorka, Abt, Sieber Concone, Nora, Luetgen, Viardot, Marchesi, Bona, Aprile, Vaccai, Vannichini, Tosti, Cowen, Chaminade, Mercadenti, Pinsuti, Donizetti, Rossini, Handel, Haydn, Mozart, Brahms, Schubert, Schumann, Franz, and Verdi.

TUITION

(Payable in Advance.)

One forty-five minute lesson per week for one semester.....$22.00
Two half-hour lessons per week for one semester 32.00

Pupils wishing to arrange for instruction by the single lesson instead of by the semester will be charged $1.50 per lesson.

No reduction will be made for any pupil who enters late in the term, or for temporary absence, or for withdrawal before the end of the term. In case of protracted illness, arrangements may be made at least a day before the lesson period.

VIOLIN DEPARTMENT.

For beginners the First Part of the Violin Schools by either Louis

Schubert, Carl Henning, Edm. Singer, or Herman, is used, and, when necessary, there are introduced easy arrangements of melodious pieces for violin with piano accompaniment, such as Melodien Sammlung, by H. Urban, etc., selections from easy duets for two violins, by Pleyel or Mazas. This is followed by Part II of Henning's Violin School; Kross' scales in two octaves; Studies, by H. E. Kaysor, op. 20, or first part of Gradus ad Parnassum, by Jacques Dont; and easy solos, by Allard, Hermann, de Beriot and others. Compositions for violins and piano are introduced as soon as practicable. Selections from the following are made according to the ability of the student: Dussek's Sonatas for piano with added violin part; sonatas for piano and violin by F. Schubert, Hauptmann, Haydn, and Mozart; Beethoven's Serenade op. 8, arranged for piano and violin, etc. Later, Part III of Henning's Violin School; Scales in Three Octaves, by Fischel; Schradiesek's Violin Technic and Tonleiterstudien; the studies of Kreutzer, Fiorillo, Rovelli and Rode; Concertos, by Viotti, or Rode; Solos by David, Allard, DeBeriot; Duettos, by Viotti or Spohr. Lastly the 24 Etudes, by Gavine, Allard's 10 Etudes Artistiques op. 19, and Abel's adaption for the violin of Cramer's Famous Piano Studies; Concertos, by Mendelssohn, Beethoven, Spohr, Molique and Max Bruch; Sonatas for the violin, by Bach; Solos by Vieuxtemps, Ernst, Wieniawski, Saraste and other modern composers.

Material for violin department can be obtained from Prof. Hey.

ENSEMBLE.

In this department, Sonatas for piano and violin by Bach, Beethoven, Mendelssohn, Schumann, Mozart, Haydn, Schubert, Grieg, Rubenstein and others are used; also many classical compositions of different forms. This department is open to advanced piano students only.

TUITION.

(Payable in Advance.)

One hour lesson per week, for one semester$35.00
Two half hour lessons per week, for one semester 35.00
One forty-five minute lesson per week, for one semester..... 26.00

Terms.—For ensemble with violin same as for violin lessons.

Regulations.—Same as for piano department.

RECITALS.

Frequent instrumental and vocal recitals are given both by members of the faculty and students, the latter being thus enabled not only to cultivate their taste by hearing the best composers interpreted by the advanced students, but to develop their own powers of performance to the fullest extent.

Pupils studying in the elementary grades, are encouraged to play at the junior recitals, as soon as they are grounded in the primary requirements of touch, phrasing and conception.

The director will be pleased to make appointments for consultation with any students who contemplate entering for a course of study.

Ensemble Class.—At the beginning of each year, ensemble classes are arranged. Students will find these classes very desirable and helpful, not only because they afford an opportunity of becoming better acquainted with the literature of concert music, but also because they insure a steadiness in playing and inspire confidence.

Oratorio Society.—This organization of Bozeman, under Prof. Oliver, as musical director, has included many students of the college musical departments and will continue to admit those who are qualified and desirous of entering. The society has a membership of about seventy-five and has been in existence six years.

College Choristers.—The glee club, consisting of twenty members, was organized three years ago by Mr. Oliver. Students who have suitable voices for singing and who read music with sufficient facility are admitted. The choristers give an annual concert.

College Band.—A band of forty pieces, under the instruction and leadership of Mr. Louis Howard, affords ample opportunity for all students who desire training in clarinet, cornet, trombone, French horn, and other band instruments. In addition to private and ensemble instruction, extensive practice is given in concerts and on public programs at college functions.

School of Art.

MRS. MARSHALL.

MRS. GAGE.

The art department has a good equipment of casts in busts, masks, parts of the human figure, ornament and geometric solids; benches and tools for wood carving and clay modeling, a kiln for china firing, a perforating machine for transferring designs for embroidery, and photographic copies of sculptures and world pictures. There is also a splendid selection of books on art.

This work is intended to famaliarize the student with the principles that underlie art, as well as with the practice of the various forms of art, chosen according to the taste of the student. Lectures are given on the principles and history of art, but the teaching is entirely individual. Among the forms of work offered are drawing, with attention to grouping, light and shade, perspective, clay modeling, wood carving, decorative designing, china painting, art embroidery; painting in oil or water colors, sketching from nature, figure study.

That the study of drawing is important in education is now universally acknowledged. Aside from the advantage to engineers, machinists, and architects, of a practical knowledge of draughtsmanship, the psychologic value of a knowledge of drawing is very great. The chief object of education is the quickening of the powers of the mind. Drawing brings out the power of analysis, habits of observation, qualities of judgment, imagination, memory and taste. It is something more than mere training of the eye. To achieve even moderate success requires that thought be put into every line. A line put down without thought is always a wrong line.

Art, aside from anything we can produce, helps us to appreciate the works of great artists and opens our eyes to the beauty of form and color in nature. It extends our powers of enjoyment and gives us a better understanding of the history of the human spirit. It gives a proper gratitude for the work of great artists.

Students who are registered in the art course are admitted without further tuition fees to such other work of the college as their preparation will permit them to pursue to advantage. Attention is called in this connection to the work offered in history, literature, language, domestic science, music (which is charged separately), and in engineering and mechanic arts.

The art course, as here outlined, wil indicate the work of the average student in a four year's course planned for those who attend mainly for the art work. All the teaching being individual, the student is carried forward just as rapidly as his own talent and industry will permit.

Every effort is made to teach correct drawing. The pupil is then en-

couraged to apply such knowledge in any direction in which his talents may seem to lie, and is allowed the use of various mediums, such as oil, water color, pastel, etc., and also may take lesons in china painting. The classes in drawing and wood carving are open to students in any of the college courses.

Attention is called to the regulation printed on page 17, regarding work done suitable for exhibition purposes.

FRESHMAN YEAR.

Drawing.—Drawing from the cast, in charcoal or crayon. Still life and object drawing. Drawing from plants and other natural forms in preparation for design. Sketching from nature, in the last few weeks of the second semester. In object drawing the pupil is required to study artistic grouping and good arrangement of light and shade. Memory and time drawing and blackboard work will be carried through the year.

Perspective.—Perspective and its practical application to the drawing of buildings, and to sketching from natcre. Perspective problems to be worked out and carefully drawn. Water color tinting for mechanical work. Several art lectures each week. Clay modeling may be studied at the discretion of the teacher.

SOPHOMORE YEAR.

General Principles of Design.—Color schemes and color harmony. Historic ornament. Each student will occasionally be required to submit original design for embroidery, wood carving and other decorative work, based upon plant forms which he has drawn during previous years.

Painting.—The painting of plants and still life in oil or water color. Pen and ink drawing. Sketching from nature as the weather will permit.

JUNIOR YEAR.

Wood Carving.—An extended course in carving as applied to furniture and other objects. Lectures on the history of wood carving.

Figure Study.—In this year there is a life class, open to all who show talent for figure drawing. Study of costume. Painting in oil and water color. Lessons on decorations of interiors.

SENIOR YEAR.

Any branch of art preferred by the student. Otherwise further instruction in branches already begun by the student. China painting may be taken up at the discretion of the teacher.

The Preparatory Cource

MISS MARY A. CANTWELL, Principal.

The preparatory school is maintained for the benefit of the young people who live in counties not having high schools, or in the rural districts not convenient to the city high schools. In addition to the usual high school course, two complete industrial courses are offered, one for boys and one for girls. With the large and well equipped kitchen, sewing rooms, shops and laboratories, this work ranks with that of the best secondary industrial schools. Many members of the college faculty give preparatory instruction in their special subjects.

The preparatory courses are based on the college entrance requirements of the Carnegie Foundation for the Advancement of Teaching, and are not tabulated by years and semesters. Fourteen units constitute a preparatory course. A student to be regular must register for at least three units (12 credits) of work. Irregular registration is allowed by vote of the faculty only. A unit consists of work to the amount of four recitation periods per week of sixty minutes each, for a year of thirty-six weeks. Two periods of laboratory, shop work, domestic science, or drawing, shall count as one recitation.

English, Mathematics, German and Latin must be taken in order as outlined by sub-courses. Two units of German or Latin must be completed to receive credit.

The following seven (7) units are required of all students:

English Composition 1	Algebra 1½
Rhetoric 1	Geometry 1½
Literature 1	Physics 1

The remaining seven (7) units shall be selected from the following list:

German 2	
Latin 2 or 3	Domestic Science 1 or 2
General History 1 or 2	Shop Work 1 or 2
Biology 1	Mechanical Drawing 1
Drawing 1	Engines and Boilers 1 or 2

For admission to the preparatory school the equivalent of an eighth grade certificate is required. Those not having eighth grade certificates will pass an examination in the common branches, or otherwise satisfy the principal before entering classes.

Military drill is required of the men and physical culture of the women.

A liberal course of reading is given in English classics during the course as a part of the required work. It is desirable, so far as possible,

for students to purchase the books and make them a part of their private libraries.

Judge F. K. Armstrong, of Bozeman, gives a prize of ten dollars to the one taking first place in an annual declamatory contest. There is also a prize of five dollars for the second best. Only regular students in the preparatory school are eligible to enter this contest.

Those who complete the course satisfactorily are granted suitable diplomas.

Description of Preparatory Course.

ENGLISH.

(a) **English Composition.**—The aim of the course is to secure accurate and graceful expression, and to afford constant exercise in composition. In connection with this work English classics will be made the subject of class room study, forming a basis for the study of literature. I and II. 1 unit.

(b) **Rhetoric.**—This is a continuation of course (a). One hour a week is given to elocution. Each student is required to write at least one paper per week, based on text book work. I and II. 1 unit.

(c) **Literature.**—The object of this course is to develop an intelligent appreciation of American and English masterpieces and to promote a taste for the best literature. A series of classics similar in number and kind to the New England College requirements are made the material for critical class room study. The student will find in the library valuable works for reference. I, II. 1 unit.

The following classics are studied in class: Shakespeare's Merchant of Venice, and Macbeth; the Sir Roger de Coverly Papers in the Spectator; Irving's Life of Goldsmith; Coleridge's Ancient Mariner; Scott's Ivanhoe, and The Lady of the Lake; Tennyson's Gareth and Lynette, Lancelot and Elaine, and the Passing of Arthur; Lowell's Vision of Sir Launfal; George Eliot's Silas Marner.

MATHEMATICS.

(a) **Algebra.**—This includes the following subjects: Addition, substraction, multiplication, division, equations of the first degree with one unknown number, simultaneous equations of the first degree, factors, highest common factor, lowest common multiple, quadratic equations, simultaneous equations above the first degree, theory of indices (positive, negative, fractional, and zero), and radicals. I, II. 1 unit.

(b) **Advanced Algebra.**—Simultaneous quadratic equations; ratio, proportion and variation, including graphical representation of simple relations between two variables; arithmetical and geometrical progressions; binomial theorem for positive integral exponents; logarithms, including use of tables in simple numerical work. I. ½ unit.

(c) **Plane Geometry.**—This includes, in addition to the work given in the standard texts, a large number of original exercises. Prerequisite, Algebra (a). II, I. 1 unit.

(d) **Solid Geometry.**—In this course special attention is given to the geometry of the sphere. Prerequisite, Algebra (a) and (b) and geometry (c). II. ½ unit.

SCIENCE.

(a) **Elementary Physics.**—Lectures with experimental illustrations, recitations, assigned problems, and laboratory work three hours per week

throughout the year in mechanics, sound, heat, light, electricity and magnetism. Text book, High School Physics, by Carhart and Chute, and Laboratory Notes, by Cobleigh.I, and II. 1 unit.

(a) **Biology.**—This course will be conducted in such manner as to give the pupils a good understanding of the first principles of the science of living things. While the subjects of the course will be taken from the field of zoology and botany, it is not the purpose to train zoologists and botanists, but to equip the pupils, by the information and training given, to observe and interpret simple biological facts. Recitations and laboratory exercises. I and II. 1 unit.

LATIN.

(a) **Begining Latin.**—In the first year's work the aim is to secure a ready knowledge of the inflectional forms, the main rules of syntax, and a vocabulary which will prepare for easy Latin reading. For this purpose Hale's First Latin Book is used, which, in connection with grammatical study, gives reading lessons adapted to the ability of the learner. I and II. 1 unit.

(b) **Latin Readings.**—Drill similar to that of the first year is continued in this course in connection with the reading of easy selections from classic authors such as are found in Rolfe and Dennison's Junior Latin Book. This includes two books of Caesar and other reading, the equivalent of two more books. Prose composition exercises based on the text are also given. I and II. 1 unit.

(c) **Cicero.**—The four orations against Catiline are read, and two others. Roman politics, as compared with those of our day, always interest students who have an intelligent interest in current events, and there is every opportunity for such comparative study in this work. Prose composition, based on the text, will be given in connection with this course, and the student will be given practice in sight reading. I and II. 1 unit.

GERMAN.

(a) **Beginning German.**—The work of the first year is of the usual elementary nature, including study of grammar, composition, pronunciation, careful reading of easy texts and sight reading. I and II. 1 unit.

(b) **German Readings.**—The second year's work is also largely practical, but affords, as well, an introduction to classic German literature. The required reading during the two years is not less than 600 pages. I and II. 1 unit.

HISTORY.

(a) **Greek and Roman History.**—The mastery of such a text as Myer's Ancient History or a briefer text on Greek and Roman history, with supplementary work in some such simple source collection as Fling's "Greek and Roman Civilization." Special attention is paid to the geog-

raphy of the ancient world, and references to other books and ocasional outside topics, are given to enable the students to grasp the subject rather than memorize the text. When possible, pictures of places or of objects of study are used. I, II. 1 unit.

(b) **Mediaeval and Modern History.**—The second year is given to mediaeval and modern history, using the same methods and with similar alternatives. I, II. 1 unit.

DOMESTIC SCIENCE.

(a) **Cooking.**—The work is both theoretical and practical. Mrs. Lincoln's text book is used. I, II. ½ unit.

(b) **Cooking and Bills of Fare.**—Much attention is giving to serving meals. For examination each pupil is given a stated amount of money, and in two hours prepares a three course luncheon for ten people. During the year each student gives two demonstrations, one of which is for the public. I, II. ½ unit.

(c) **Sewing.**—Plain and machine sewing with some practice in garment making. Each student furnishes her own materials, as the garments made form part of her own wardrobe. I, II. ½ unit.

(d) **Sewing, Garment Making.**—In this course at least five garments and one shirt waist must be completed. I, II. ½ unit.

DRAWING.

(a) **Drawing.**—Freehand drawing from geometric solids and casts, Study of light and shade. Clay modeling. Object drawing. Study of plant forms, with suggestions for their application to design. Memory and time drawing. Blackboard work frequently. I and II. ½ unit.

(b) **Drawing.**—Continuation of course (a) with increase of work in water color, wood carving, oil painting, etc. I and II. ½ unit.

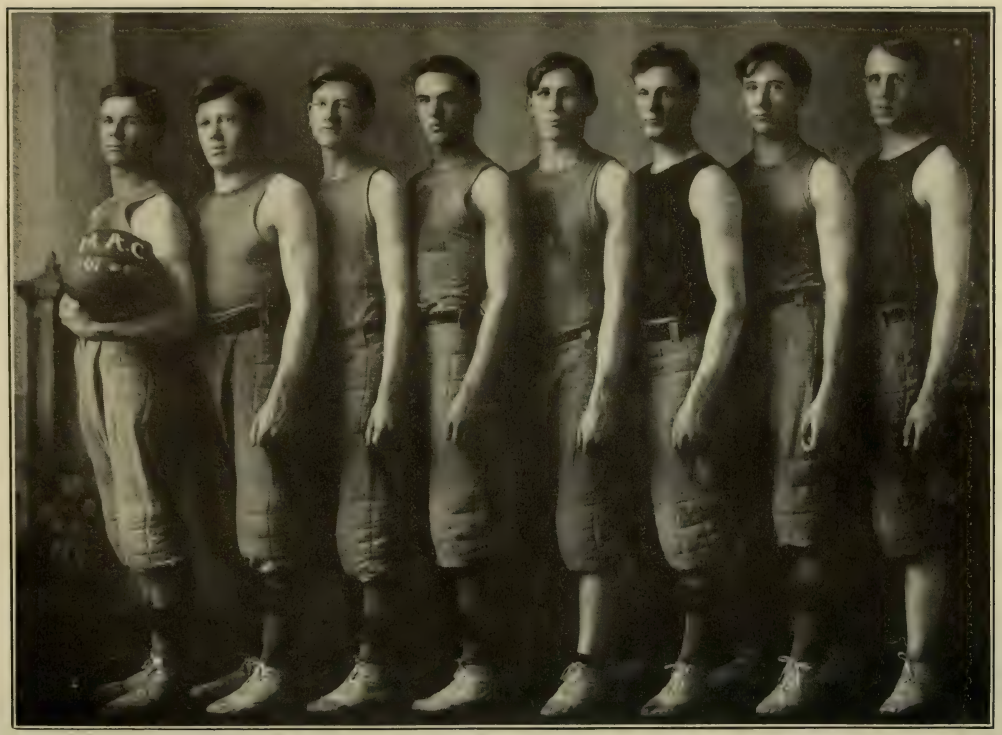
MECHANICAL DRAWING.

(a) **Mechanical Drawing.**—The first year's work, while not in any way duplicating the work of the art department, is mostly freehand drawing and lettering. The lettering is of a kind most suitable for mechanical drawings. The sketching is almost entirely done from objects and is given in such a way that it leads directly up to mechanical drawing. The necessary views, the proper dimensions, and the most desirable method of indicating the dimensions in order to make a satisfactory working drawing, is a prominent feature of the work, and much effort is made to give the student that understanding of the relation of the drawing to the object, which will enable him to work from drawings. Some work with instruments is done, in the first year, making mechanical drawings from the freehand sketches. Prerequisite, one year's work in freehand drawing in the art department. I, II. ½ unit.

(b) **Mechanical Drawing.**—The second year's work is a continuation of the first, but comprises more use of the instruments. Detail drawing,



GIRLS' BASKET BALL TEAM.



BOYS' BASKET BALL TEAM.

isometric and cabinet drawings, shading, water colors, and tracing complete the work of this course and gives the student a sufficient knowledge of the subject to enable him to make use of it in commercial work if he decides not to pursue his studies further. Prerequisite, mechanical drawing (a). I, II. ½ unit.

SHOP WORK.

(a) Joinery.—The use and care of bench tools; graded exercises in joinery to develop skill and to secure accuracy in reading blue prints. Turning. The use of power lathes and lathe tools; graded exercises in spindle and face plate work, and the manufacture of standard articles for shop use, ornamental pieces, etc. I. ½ unit.

(b) House Carpentry.—Exercises illustrating the methods and principles of framing, rafter and stair cutting, and finishing. Cabinet work. The use of standard wood shop machinery in the manufacture of tables, work benches, book cases, office desks and other furniture. Prerequisite, wood work (a). II. ¼ unit.

(c) Forge Work.—The operation of hand and power forges, and care of the fire, with graded exercises in iron forging designed to teach the operations of drawing, upsetting, bending, forming and welding. Prerequisite, wood (a) and (b). To be taken with mechanical drawing (a). I. ¼ unit.

(d) Forge Work.—A continuation of (c), with practice in case hardening, and in tempering simple tools, and lectures on the hardening, tempering and annealing of tool steel. Prerequisite, forge work (c). With mechanical drawing (a). II. ¼ unit.

(e) Forge Work.—Practice in forging and tempering tool steel in hand tools, lathe tools, taps, dies, milling cutters, etc. Prerequisite, forge work (d). With physics and mechanical drawing (b). I. ¼ unit.

(f) Machine Work.—Bench work, including chipping, filing, scraping, fitting, soldering, and brazing. Prerequisite, forge work (c), (d) and (e). With physics and mechanical drawing (a). II. ¼ unit.

(g) Machine Work.—A continuation of the preceding, with machine tool work on drill press, shaper, planer, and lathe. Prerequisite, machine work (f); physics and mechanical drawing (a) and (b). I. ¼ unit.

(h) Machine Work.—Advanced work on lathe, milling machine and tool grinder. Prerequisite, machine work (g). II. ¼ unit.

BOILERS AND ENGINES.

(a) Steam Boilers.—The construction and operation of steam boilers, and their auxiliaries, including the care of boilers, their strength and evaporative capacity, the physical properties of steam, combustion of fuel, pumps, injectors, feed water heaters, condensers. Prerequisites, physics, solid geometry, mechanical drawing (a), (b) and machine work (f). I. ½ unit.

(b) Steam Engines.—The construction and operation of reciprocating

engines; valves and valve gears; governors; lubricators; indicator cards; indicated horse power; brake horse power; efficiency; belts and pulleys. Prerequisite, steam boilers (a). II. ½ unit.

(c) **Boiler and Engine Practice.**—Practice with traction engine and in boiler room and laboratory. Taken only with (a) and (b). I and II. ½ unit.

(d) **Gas Engines.**—The principles of construction and operation of engines using kerosene, gasoline, alcohol, and gas. The proportioning of mixtures; carburetors; ignition governing; horse power. Prerequisites, physics, solid geometry, mechanical drawing (a), (b), and machine work (f). I. ¼ unit.

(e) **Gas Engine Practice.**—Practice in the manipulation and testing of gas engines with various fuels. Taken only with gas engines (d). I. ¼ unit.

School of Agriculture.

A great majority of the young men in the rural communities finish their education in the common schools. They have had little or no opportunity to become acquainted with the science underlying farm work. The young men who expect to become farmers are cordially invited to enter the course in the school of agriculture. The aim is to educate the student toward the farm, and to develop a love for farm life by showing the possibilities of scientific agriculture.

The course extends through three years of six months each and comes in the winter season, when the young people can be spared from farm work. For entrance to this course, a student must have finished the 8th grade of the common schools or its equivalent. Those who satisfactorily complete this course will be given diplomas. The general fee of $6.00 is charged; laboratory fee of $2.00 is required in dairying and chemistry. The shop deposit is $4.00 per year.

FIRST YEAR.

English Composition (Eng. d)....2	English Composition (Eng. d)....3
Elementary Physics (Physics b).3	Physics (Physics b).....3
Carpentry (a)..... 2	Carpentry (b) 2
Nursery Practice (Hort. a).....3	Breeds of Livestock (An. Ind. b)..3
Animal Types (An. Ind. a).....3	Crop Production (Agron. a).....4
Poultry (An. Ind. a).....3	Vegetable Gardening (Hort. b)...3
Botany (Biol. b) 4	Civics 3
Drill 1	Drill 1
22	22

SECOND YEAR.

Rhetoric (Eng. e).....2	Rhetoric (Eng. a).....2
Elementary Chem. (Chem. a)....2	Elementary Chem. (Chem. a)....3
Field Crops (Agron. b).....4	Plant Diseases (Biol. c).....4
Orcharding (Hort. c).....4	Forestry (Hort. d).....4
Farm Dairying (Dairy a).....3	Cheese Making (Dairy b).....3
Forge Work (c) 3	Forge Work (d)..... 3
Mechanical Drawing (a).....2	Soil Physics (Agron. c).....4
Drill 1	Drill 1
22	22

THIRD YEAR.

Literature (Eng. f).....2	Literature (Eng. f) 2
Economic Entomology (Biol. d)..4	Economic Entomology (Biol. d)...4
Principles of Breeding(An. Ind. d) 4	Livestock Feeding (An. Ind. c)...4
Agr. Mechanics (C. E. a).....2	Agri. Mechanics (C. E. a).....2
Veterinary Science (An. Ind. f)..3	Veterinary Science (An. Ind. f)...4
Soil Fertility (Agron. d).....3	Farm Management (Agron. e)....3
Landscape Gardening (Hort. e)..3	Elective 2
Drill 1	Drill 1
22	22

Any student who has finished the school of agriculture course may enter the freshman year of any college course by completing six additional units of preparatory work, in which must be included one unit each of English, algebra and geometry.

Equipment.

Students in this course have the advantage of a modern dairy in daily operation, a complete plant with several breeds of the best poultry, model farm buildings and barns, with pure bred live stock, the experiment station farm, green houses and orchards, the large biological, chemical and physical laboratories, and the well equipped wood and iron shops of the engineering departments. The methods employed are practical. The instruction is supplemented with practice in the laboratories, the dairy, the orchards, the grenhouse, and with the herds. Visits are also made to other farms and herds in the neighborhood.

AGRONOMY.

(a) **Crop Production.**—This course includes a study of the principles underlying, and the factors influencing reproduction, germination, and growth in agricultural plants. II, 4.

(b) **Field Crops.**—A study of the various classes of farm crops, their history, cost of production, consumption, products and by-products. In this course, some time is devoted to the judging of grains. I, 4.

(c) **Soil Physics.**—A review of the origin, formation and classification of soils, and a careful study of the conditions, influencing the supply of heat and air and moisture as related to growing plants. II, 4.

(d) **Soil Fertility.**—Maintenance of fertility, fertilizers, and rotation. The influence of manure and the effect of the different crops upon the productive capacity of the soil and upon succeeding crops. I, 3.

(e) **Farm Management.**—This course considers the business side of farming as an industry, also the relation of farming to the other industries. II, 3.

ANIMAL INDUSTRY.

(a) **Animal Types**—Or a study of types as related to production and work. Three types of cattle, the dairy, beef, and dual purpose; the market classes of horses, the bacon and lard types of hogs, and the mutton and wool types of sheep. I, 3.

(b) **Breeds of Live Stock.**—This is a study of the different breeds of live stock, of the forces which have produced them, and of their adaptability to various conditions and management. II, 4.

(d) **Principles of Breeding.**—This course includes a study of the laws of heredity, correlation, reversion, variation, fecundity, methods of breeding, crossbreeding, selection, etc. I, 4.

(e) **Poultry.**—Type and management. Feeding and care of poultry. I, 3.

(f) **Veterinary Science.**—The work in veterinary science consists principally of the study of the different diseases most commonly affecting farm stock, with special reference to diagnosis and treatment. I, 3.

DAIRYING.

(a) **Farm Dairying.**—The study of dairying as related to the farm; the care of the cows; the production of sanitary milk, and the handling of the milk for the creamery and city delivery; the construction of milk houses and stables; the advantages of the hand Babcock tester on the farm and the making of the test; a comparison of the gravity and hand separator methods; how to set up and care for the separator so as to get the best results; an opportunty is afforded to study and compare all the leading makes of hand separators. Butter making takes up the practical methods to be employed on the farm for the ripening of the cream, the churning, packing and marketing of butter. I, 3.

(b) **Cheese Making.**—The making of cheddar cheese on the farm. This will comprise a study of the care of the milk for cheese making; the process of manufacture, and the curing and marketing. A short course is given also in creamery accounts, with particular reference to the paying for milk or cream at the creamery, and the general handling of the business end of the creamery, to fit young men for co-operative creamery managers and secretaries. II, 3.

HORTICULTURE.

(a) **Nursery Practice.**—This subject deals with the propagation of fruit and ornamental plants for both home and commercial purposes. The work is given in lectures, text book, and practice in the laboratory and greenhouse. I, 3.

(b) **Vegetable Gardening.**—The methods of growing vegetables in the field and under glass, hot bed construction and management, and the marketing and gathering of vegetables are treated in lectures, text books and practice in the field and greenhouses. II, 3.

(c) **Orcharding.**—The growing, harvesting and marketing of tree and small fruits are studied. Special attention is given to the methods of culture and varieties adapted to Montana conditions. The experiment station orchard offers good opportunities for student work in fruit growing. I, 4.

(d) **Forestry.**—The planting and growing of wind breaks upon farms, the effect of forests upon farm lands, methods of conservative lumbering and preservation of forests, the effect of forests upon water supply, rainfall, temperature, etc., are features of this course. II, 4.

(e) **Landscape Gardening.**—In this course particular attention will be given to the study of plans for laying out and planting farm homes.

the trees, shrubs, and flowering plants suitable for Montana conditions will be studied with methods of propagating and growing them. I, 3.

BIOLOGY.

(b) **Botany.**—Two recitations and two laboratory periods per week. The elements of botany are taken up, especially with a view to the needs of agricultural students. The classification, physiology and ecology of plants are briefly covered. I, 4.

(c) **Plant Diseases.**—Two recitations and two laboratory periods per week. So far as possible in the limited time available the diseases of the various agricultural and horticultural plants will be studied. This work will be conducted upon a scientific basis but at all times the needs of the practical agriculturist will be kept in view. II, 4.

(d) **Entomology.**—Two recitations and two laboratory periods per week. After a very brief survey of the animal kingdom, the anatomy, physiology, habits, transformations, and classification of insects are studied, together with the methods of controlling injurious species. This course is designed, in a comprehensive manner, to prepare the student for defense against the various insect pests of the farm, orchard and garden. I, II 4.

CHEMISTRY AND PHYSICS.

(a) **Elementary Chemistry.**—Lectures with experimental demonstrations, recitations and laboratory work on the fundamental principles of chemistry, the occurrence, preparations and uses of the common elements and their compounds. The applications of chemistry to agricultural problems will be frequently pointed out. Text book, Remsen's Elements of Chemistry. I and II 6.

(b) **Elementary Physics.**—Experimental lectures, recitations and assigned problems three hours per week on topics selected from mechanics, heat, light, electricity, and magnetism. Emphasis will be placed upon these subjects which either have a direct application to agricultural problems or are desirable as a preparation for some subsequent study in the course. The lectures will be illustrated with numerous experiments and lantern slides. It will be from properly interpreting the class room exercises and from the work of many practical problems that the student will derive the most benefit. Carhart and Chute's High School Physics will be used as a text book. I, II, 6.

ENGLISH.

(d) **English Composition.**—The first year is devoted largely to practice in the simpler forms of composition. Attention is given to business forms, letter writing, narration, and to the forming of habits of correct speech. I, II 6.

(e) **Rhetoric.**—During the second year more advanced work is given

in composition, with frequent essays, reviews, etc. A few masterpieces are studied as a basis for style of expression. I, II, 4.

(f) **Literature.**—The third year gives a comprehensive study of English and American literature. The object is to develop an appreciation for the works of the standard authors and a taste for the great masterpieces of the language. I, II, 4.

AGRICULTURAL MECHANICS.

(a) **Farm Mechanics.**—A study of the construction and operation of the various machines used on the farm. Gasoline engines, pumps, binders, mowers, cleaners, and other farm machines will be taken apart and assembled by the students. Special attention will be given to pumping machinery—pumps, windmills, steam, gas and gasoline engines and their application to irrigation. Considerable attention will be given to the cost of operation and conditions governing the life and efficiency of pumping machinery.

MECHANIC ARTS.

For carpentry, forge work, and mechanical drawing, see description of courses in preparatory school.

School of Pharmacy

PROF. MOLLETT.

This school offers a two year course in pharmacy, leading to the degree of pharmaceutical chemist (Ph. C).

The object is to provide the people of the state with reliable and competent pharmacists.

This course requires two full academic years for completion and provides the foundation in materia medica, pharmacy and analytical chemistry as applied to the drug business, and required for pharmaceutical manufacture and dispensing; and also thoroughly qualifies the graduate to meet the examination given in any state for the position of registered pharmacist.

Candidates for admission to the course must be at least eighteen years of age and may be admitted (a) By presenting a certificate from an accredited high school, showing that not less than one year of work has been completed; (b) by examination on an equivalent amount of work in subjects designated by the college; (c) by faculty approval of grades from other than accredited high schools.

While it is not compulsory, it is advised that students have one or two years practical training in a drug store.

In addition to the annual tuition fee of $12.00 for this course, deposits are required as follows. Pharmacy (3), $10.00; (4), $2.00; (5), $2.00; (6), $1.00; (7), $8.00; (9), $4.00; (11), $6.00.

The students have access to such of the chemical and botanical laboratories as the work calls for, as well as those of pharmacy and materia medica. These laboratories contain all the modern equipment necessary for the proper instruction of the students. Free access is also granted to the standard reference books in the several branches of science, and the magazines and journals of chemistry and pharmacy.

Lectures will be given through out the course on chosen subjects, by those who have gained prominence in pharmaceutical pursuits, and in the sciences closely related to pharmacy, i. e., pharmaceutical economics, anatomy, emergency aid, pharmaceutical jurisprudence, pharmaceutical chemistry, etc. All pharmacy students will be required to attend these lectures, for which a credit of one hour is given for the semester.

All regular students will be required to keep notes on the work done, and present the same for examination and rating. Oral and written quizzes will be given during each course, and a final written examination at the close of the senior year covering the entire course of instruction in pharmacy. This examination will resemble in every respect those given by the state board of pharmacy.

PHARMACY.

JUNIOR YEAR.

Gen. Inorg. Chemistry (Chem. 1)	4	Gen. Inorg. Chemistry (Chem. 1)	4
Gen. Botany (Biol. 9)	5	Physiology (Biol. 3)	4
Introductory Pharmacy (1)	5	Official Pharmacy (2)	3
Pharmacy Latin	4	Pharmacy Laboratory (3)	2
		Pharmacognosy (4)	4
		Micros. Study of Po. Drugs (5)	2
	18		19

SENIOR YEAR.

Organic Chemistry (Chem. 5)	3	Organic Chemistry (Chem. 5)	3
Qualitative Analysis (Chem. 2)	4	Quantitative Analysis (Chem. 3)	4
Inorganic Pharmacy (6)	4	Materia Medica and Therapeutics (8)	4
Pharmaceut. Testing and Drug Assaying (7)	3	Dispensing (9)	1
Bacteriology (Biol. 12)	1	Toxicology (10)	1
Lectures		Physiological Chemistry (11)	2
Mineralogy (Chem. 11)	3	Thesis	4
	18		19

PHARMACY.

(1) **Introductory Pharmacy.**—The course consists of a thorough study of the history of pharmacy; the authoritative guides and books of reference; the theory in the use of pharmaceutical apparatus; a systematic study of the subjects of weight, measure, specific gravity, specific volume, percentage solution; and all the common processes in pharmacy, and the principles of pharmaceutical arithmetic involved, together with the many operations of the dispensing counter. The official classification of galenical preparations is also considered. Lectures and recitations, I, 5.

(2) **Official Pharmacy.**—A continuation of course 1, and must be preceded by it; consisting of a thoroughly scientific study of the preparations in the United States Pharmacopoeia and National Formulary. The galenicals are carefully considered with regard to classification, technical nomenclature, mode of preparation, preservation, percentage composition and dose of each individual preparation. Texts, U. S. Pharmacopoeia, eighth revision, and National Formulary, third edition. Lectures and recitations, II, 3.

(3) **Pharmacy Laboratory.**—A practical laboratory course in which most of the important, and many of the difficult medicinal preparations of the U. S. Pharmacopoeia are manufactured by each student, especially the typical representatives of each class of galenicals, such as waters, tinctures, fluid extracts, spirits, elixirs, pills, suppositories, ointments, etc. Neatness, accuracy, quantity and quality of work done will determine the students' standing. II, 2.

(4) **Pharmacognosy.**—A study of the natural history and important

features of crude drugs; the means of identification and selection; constituents, action, dose, and official preparations. The official organic drugs and some of the commonly used unofficial ones will be studied in the follow- order: (a) Plant drugs—Roots, rhizomes, tubers, bulbs, leaves and leaflets, herbs and flowers, fruits and seeds, gums, resins, balsams, etc. (b) Animal drugs—The student has actual access to the typical specimens in the materia medica laboratory. Lectures and laboratory exercises, II, 4.

(5) **Microscopical Study of Powdered Drugs.**—This course consists of the study of powdered vegetable drugs and their common adulterants by the aid of the microscope. By the preparation of slides and drawings the student learns the most important characteristics of the different drugs most commonly adulterated and their common adulterants, and is thus enabled to determine questions of identity and purity. Lectures and laboratory exercises, II, 2.

(6) **Inorganic Pharmacy.**—Inorganic salts, acids and their official preparations, source, manufacture, means of identity, impurities, strength, solubility and dose are considered. This course is in reality a continuation of general inorganic chemistry, in which many of these substances are prepared in an experimental way in the laboratory. The students have access to the U. S. P. specimens in the materia medica laboratory. Must be preceded by chemistry 1 and 2. Lectures, recitations and laboratory work. I, 4.

(7) **Pharmaceutical Testing and Drug Assaying.**—This is largely a laboratory course; practice in testing the purity and strength of the inorganic medicines, chemicals, organic drugs, and prepartions, according to the methods of the U. S. Pharmacopoeia. Lectures, recitations and laboratory work. I, 3.

(8) **Materia Medica and Therapeutics.**—Lectures and recitations on the physical, physiological, chemical and therapeutic properties, and classification of the materials used for curative and remedial purposes. Special attention is given to the active constituents of crude drugs, and their action on the human body. Therapeutic classification and application of medicinal substances to the treatment of diseases will be studied and the student thoroughly drilled in dosage and methods of dispensing. Lectures and recitations. II, 4.

(9) **Dispensing.**—A technical study of all phases of the prescription, detection of defects, errors and incompatibilities, practice in reading and copying prescriptions in order to acquire accuracy and legibility; practice in the use of an approximate price scale; methods of numbering and filing prescriptions and practical work in the art of compounding and dispensing. Lectures and laboratory exercises. II, 1.

(10) **Toxicology.**—Lectures and recitations, covering the actions of poisons on the human body, methods of detection, antidotes and toxic

posology, and such knowledge of the subject as is indispensable in the safe practice of pharmacy. A brief study of the Montana pharmacy law with special regard to the lawful sale of medicines and poisons. II, 1.

(11) **Physiological Chemistry.**—A brief study of the fundamental principles and facts of carbohydrates, proteins, normal and abnormal products of animal life. The analysis of the various secretions, e. g., saliva, gastric and pancreatic juices. Urinanalysis, chemically and microscopically. Lectures and laboratory work. II, 1.

(12) **Thesis.**—All students in pharmacy are required to prepare a graduating thesis upon some subject relating to the pharmacy profession. The outline of this thesis should be presented for approval at the beginning of the senior year, or, in the two year course, at the beginning of the second semester.

One Year Course in Household Economy

The one year course is intended for those who wish systematic work in household economy and who cannot take the time for a four year course. The work is necessarily much more elementary than in the longer course, and no degree is given. A diploma, crediting the student with one year's work, is given upon the satisfactory completion of the course.

Cooking (g) 4	Cooking (g)..... 4
Household Economy (e).... ..4	Sanitation (f) 4
Sewing (b) 4	Sewing (h) 4
Art (e) 1	Art (c) 1
Music or English 4	Music or English 4

(6) **Household Economy.**—House construction and material furnishings, management, and care of all parts of the house. The text book used is Miss Parloa's Home Economics. Lectures on marketing are also given, including such subjects as methods of buying, home and foreign products, care of supplies, household arts, as cleaning, sweeping, cleaning paint, windows and metals, care of dining room, duties of hostess and waitress, table etiquette, planning bills of fare, and calculation of cost of various dishes made in the cooking class. Five papers must be handed in during the semester on some subject pertaining to home economics. Five lectures each week. , 5.

(1) **Sanitation.**—The house site, surroundings, cellar, ventilation, lighting, heating, plumbing, drainage, water supply, disposal of refuse, general care of the house. Five papers must be handed in during the semester. Five lecture periods per week. II, 5.

(g) **Cooking.**—This work is both theoretical and practical. During the second semester each student gives one demonstration. Much attention is giving to serving meals. For final examination each student prepares two three-course luncheons. I and II, 8.

(h) **Sewing.**—During the first semester six garments must be completed. During the second semester four shirt waists, a coat suit, or lined dress, and the graduating dress must be completed. I, 8; II, 12.

(c) **Dairying.**—The elaboration, composition, properties, and fermentations of milk. The methods used in testing, buying, and preserving milk for food, or for manufacturing purposes. The manufacturing of butter and cheese, with explanations of the defects in much of the butter and cheese used for domestic purposes, and how these defects may be detected and overcome. Students who desire may take practical work in the college dairy along with the special dairy students, in both butter and cheese making. I, 2.

(c) **Art.**—Freehand drawing from geometric solids and casts. Study of light and shade. Clay modeling. Object drawing. Study of plant

forms, with suggestions for their application to design. Memory and time drawing. Blackboard work frequently.

Short Courses in Agriculture

In order that those farmers who are not in a position to attend one of the longer courses may have an opportunity to get somewhat in touch with the most modern ideas in agriculture, farmers' short courses are offered. These courses embrace discusions along the lines of crop and soil management, stock feeding and management, and points of interest to the dairy farmer and butter maker.

There are no entrance requirements to these courses. To cover expenses incurred in connection with the course a fee of $2.00 will be charged. Outside of this, the only cost will be for living expenses, which are moderate in Bozeman.

For the convenience of those desiring to take only the special topics, the courses have been arranged as follows:

First week, January 6th to 12th.

Crop and soil management.....15 lectures.
Stock feeding and selection of feeding animals.....15 lectures.

Second week, January 12th to 19th:

The selection and management of dairy cattle.....15 lectures.
Home dairying.....15 lectures.

January 20th to February 18th—Creamery Butter Makers' Course.

FOUR WEEKS' CREAMERY COURSE.

Beginning just after the series of short courses for farmers there will be a four weeks creamery course, running from January 20 to February 18. As there is a growing demand for butter and cheese makers in the state, this course has been designed to especially fit young men to fill these positions. The course will last four weeks, and all of the student's time will be spent in the college creamery and in doing the actual work on the dairy floor. By this means he will be brought into touch with the problems of the average factory. In addition to the creamery practice, two lectures will be given each day, dealing with subjects that it will be impossible to take up in the practice on account of the short time allowed for this work. On the last day a final examination will be held. By this means, as well as by the students' work in the creamery, it will be possible to judge of their ability to fill available positions.

GRADUATING CLASS, JUNE, 1907.

MASTER'S DEGREE.

Sackett, Charles T.	C. E.	Livingston

BACHELORS' DEGREES.

Baker, Harold E.	Elect. Eng.	Bozeman.
Breneman, Anna T.	Math-Phys.	Bozeman
Bull, Frieda M.	Math-Phys.	Bozeman
Burke, Edmund	Chemistry	Bozeman
DeMuth, Maud S.	Math.-Phys.	Peru, Ind
Flager, Harold J.	Elect. Eng.	Red Lodge
Griffith, Warren J.	Elect. Eng.	Gebo
Hartman, Lois	Dom. Science	Bozeman
Kinney, Ed. D.	Civil Eng.	Bozeman
Lorentz, Floyd S.	Elect. Eng.	Toston
Mountjoy, Agnes	Math.-Phys.	Twin Bridges
Osborn, Belle	Dom. Science	Bozeman
Pease, Levi J.	Civil Eng.	Bozeman
Penwell, Clyde C.	Elect. Eng.	Utica
Quaw, Thomas B.	Biology	Bozeman
Thorpe, Elizabeth	Hist-Literature	Bozeman
Thorpe, Mabel A.	Math.-Phys.	Bozeman

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POSTGRADUATES.

Bull, Frieda, B. S.,	Math.	Bozeman
Chaffee, Sarah, B. S.	Biology	Bozeman
Kinney, Ed. D., B. C. E.	Elect. Eng.	Bozeman
Quaw, Lucile, B. S.,	Domestic Science	Bozeman

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SENIORS.

Alward, Mamie L.	Chemistry	Bozeman
Butter, Donald	Elect. Eng.	Culbertson
Cooke, Amy M.	Math-Phys.	Bozeman
Driscoll, Wm. J.	Civil Eng.	Lawrence, Mass
Fisher, Charles M.	Elect. Eng.	Bozeman
Hartman, Will S.	Civil Eng.	Bozeman
Mountjoy, Irvine	Elect. Eng.	Twin Bridges
Robinson, J. Wilbur	Chemistry	Bozeman
Tracy, Edna	Chemistry	Bozeman
Widener, Carl C.	Civil Eng.	Bozeman

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JUNIORS.

Brewer, Lucile	Domestic Science	Gordon, Neb.
Buell, Grace	History-Literature	Bozeman
Bull, Edna	Domestic Science	Bozeman
Cooley, Ralph S.	Agriculture	Lo Lo
Edwards, Timothy F.	Civil Eng.	Frazee, Minn.

Hansen, Gilbert E.	Elect. Eng.	Bozeman
Henderson, C. Lisle	Elect. Eng.	Livingston
Hind, Bert. S.	Elect. Eng.	Kendall
James, John S.	Civil Eng.	Cascade
Kimpton, Addie P.	Domestic Science	Radersburg
King, Ruby E.	Domestic Science	Bozeman
Kirscher, W. Guy	Elect. Eng.	Townsend
Livingston, Walter T.	Civil Eng.	Bozeman
Morris, Elwood	Agriculture	Virginia City
Noble, Erma	Domestic Science	Bozeman
Peters, Orville S.	Elect. Eng.	Clinton, Wis.
Spain, W. Whitfield	Agriculture	Bozeman
Vreeland, Edna	Domestic Science	Bozeman
Wilson, Elva A.	History-Literature	Bozeman

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SOPHOMORES.

Accola, Louise	Domestic Science	Bozeman
Allard, Louis	Biology	Laurel
Allen, Edgar W.	Biology	Joliet
Annin, James T.	Agriculture	Columbus
Bancroft, Raymond	Agriculture	Oakley, Kan.
Barnard, Robert B.	Elect. Eng.	Great Falls
Bell, James C.	Agriculture	Gilt Edge
Berg, Benjamin E.	Elect. Eng.	Columbus
Booker, Clinton T.	Elect. Eng.	Helena
Bower, Eva	History-Literature	Bozeman
Brown, Archie S.	Elect. Eng.	Great Falls
Buell, Vera	History-Literature	Bozeman
Carmichael, Effie	Domestic Science	Bozeman
Davidson, Mary	Domestic Science	Bozeman
DeMuth, David R.	Civil Eng.	Peru, Ind.
Fisher, Helen	Domestic Science	Bozeman
Flager, Ruth	Domestic Science	Red Lodge
Fox, Hazel	Math-Phys.	Bozeman
Froebe, Frank J.	Civil Eng.	Absarokee
Hartman, June	Math-Phys.	Bozeman
Henderson, Charles F.	Elect. Eng.	Hall
Hodson, Rodney	Civil Eng.	Lat
Hogan, George R.	Agriculture	Musselshell
Homann, Fred C.	Mech. Eng.	Bozeman
Keeler, Otis E.	Elect. Eng.	Bozeman
Keene, Franklin U.	Civil Eng.	Townsend
Keene, Newton	Mech. Eng.	Townsend
Kennedy, Cyril C.	Elect. Eng.	Glendive
King, Charles	Elect. Eng.	Fort Benton
King, Willard	Biology	Whitehall
Livingston, Mildred	Domestic Science	Bozeman
LeFevre, Wm. T.	Biology	Kalispell
Luther, J. Glenn	Elect. Eng.	Choteau
McCullough, Grace	Art	Gebo
Miller, Mary	Biology	Miles City
Pool, Louis K.	Civil Eng.	Townsend
Quaw, Eugene C.	Chemistry	Bozeman
Sloan, Glenn	Civil Eng.	Helena

Smith, Walter A.	Agriculture	Fridley
Soper, Charles H.	Elect. Eng.	Bozeman
Spain, Marvin	History-Literature	Bozeman
Stanton, Paul	Elect. Eng.	Helena
Thorpe, Harriet C.	Domestic Science	Bozeman
Wade, Arthur M.	Elect. Eng.	Hopkins, Minn.
Walchli, Fred E.	Elect. Eng.	Kalispell
Willson, Herman E.	Agriculture	Bozeman
Wilson, Harmon, B.	Civil Eng.	Bozeman
Wylie, Mary G.	Domestic Science	Bozeman

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FRESHMEN.

Anderson, Lee B.	Elect. Eng.	Bozeman
Armstrong, Edith	Domestic Science	Bozeman
Auerbach, William	Art	Havre
Baker, Florence	History-Literature	Bozeman
Bennett, Wm. A.	History-Literature	Bozeman
*Bessette, William	Mech. Eng.	Fulton
Breneman, Helen	Math-Phys.	Bozeman
Brown, Willard	Mech. Eng.	Glendive
Busch, Apollo G.	Elect. Eng.	Bozeman
Cameron, Gertrude	Math-Phys.	Bozeman
Carr, Irene	Domestic Science	Bozeman
Chisholm, Sarah A.	Domestic Science	Bozeman
Clark, Ben A.	Civil Eng.	Hunter's Hot Springs
Cline, Eva	History-Literature	Redlands, Cal.
Cooke, Ruth	Domestic-Science	Bozeman
Coombs, Ethelbert	Mech. Eng.	Laurel
Cox, Harvey	Pharmacy	Bozeman
Dahling, Hugo J.	Elect. Eng.	Bozeman
Draper, Irvin A.	Mech. Eng.	Red Lodge
Duncan, Zoe	Art	Bozeman
Edsall, Wm.	Elect. Eng.	Bozeman
Ellis, Edward	Elect. Eng.	Bozeman
Ferris, Elizabeth	Domestic Science	Bozeman
Fiske, Gretchen	Domestic Science	Helena
Fuller, Ruth	Domestic Science	Billings
Gray, Wright	Agriculture	Bozeman
Haines, Will	Elect. Eng.	Sheridan
Hamilton, Everett A.	Elect. Eng.	Belgrade
Heron, Robert S.	Elect. Eng.	Belt
Hapner, Bert	Civil Eng.	Bozeman
Higgins, Lucile	Math-Phys.	Townsend
Hinman, Ruth E.	Domestic Science	Bozeman
Holling, Joe	Elect. Eng.	Glendive
Hutton, Lontie H.	Elect. Eng.	Jeffers
James, Charles A.	Civil Eng.	Miles City
Johnson, F. L.	Elect. Eng.	Great Falls
Johnson, Daily D.	Elect. Eng.	Helena
Kittams, Samuel A.	Agriculture	Straw
King, Glenn R.	Mech. Eng.	Fort Benton
Kirk, Grace	Domestic Science	Bozeman
Koch, L. B.	Civil Eng.	Bozeman
Kountz, Mamie	Art	Bozeman

*Deceased.

Lehrkind, Tillie	Domestic Science	Bozeman
Metheny, Blanche	Math-Phys.	Bozeman
Metcalf, Mollie E.	Domestic Science	Phillipsburg
Miller, Archie H.	Civil Eng.	Hopkins, Minn.
Mitchell, Paul	Pharmacy	Bozeman
Mitchell, Agnes	Domestic Science	Bozeman
Moore, P. J.	History-Literature	Two Dot
Morris, Ernest R.	Civil Eng.	Virginia City
Murphy, Sam	Elect. Eng.	Livingston
Philpott, June	Chemistry	Bozeman
Phillips, Elizabeth	Domestic Science	Lewistown
Piedalue, Irene	Domestic Science	Bozeman
Robinson, J. Fred	Agriculture	Bozeman
Rhoades, Mabel	Domestic Science	Bozeman
Sheriff, Court, jr	Agriculture	Helena
Snider, Leta	Math-Phys.	Bozeman
Sweeney, C. P.	Mech. Eng.	Great Falls
Tillson, Frank	History-Literature	Carrington, N. D.
Tremper, Wm. J.	Civil Eng.	Helena
Van Voast, Shirley D.	Civil Eng.	Townsend
Vreeland, Ruth	Math-Phys.	Bozeman
Widener, Faye	Math-Phys.	Bozeman
Wilcox, Guy M.	Elect. Eng.	Dupuyer
Wilkins, Ed. C.	Elect. Eng.	Pony
Williams, Elmer J.	Elect. Eng.	Great Falls
Williams, J. H.	Mech. Eng.	Elkhorn
Williams, Sidney A.	Elect. Eng.	Boulder
Williams, Roy B.	Elect. Eng.	Bozeman
Wolpert, Harold E.	Elect. Eng.	Boulder
Woodward, Frank A.	Elect. Eng.	Great Falls

*Deceased. —72

IRREGULARS.

Arnold, Alberta	Domestic Science	Bozeman
Bond, L. M.	Agriculture	St. Paul, Minn.
Blackburn, J. R.	Agriculture	St. Paul, Minn.
Conard, Blanche	Pharmacy	Bozeman
Ferris, Margaret	Art	Bozeman
Gottschalck, Carl	Pharmacy	Bozeman
Jacques, Jean L.	Agriculture	Butte
Kinney, Harriet	Math-Phys.	Bozeman
Shipley, W. H.	Chemistry	Bozeman
Throm, Will	Civil Eng.	Helena
Wilson, Nicholas	Pharmacy	Bozeman

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PREPARATORY DEPARTMENT.

FIRST YEAR.

Bancroft, Alma	Bozeman	Kuntz, Louis	Helena
Bechtel, Hazel	Butte	Lain, Hans	Lennep
Berg, Arthur	Radersburg	Lewis, Roy	Clara
Carter, Arnold	Salesville	Martin, Harvey,	Hunter's Hot Spgs.
Clark, John	Springhill	Moore, Inez	Bozeman
Deatley, Rex	Clyde Park	Nelson, Peter	Chinook
Dunlap, Alexander	Lock	Nichols, Horace	Bozeman

Ford, Bessie Manhattan
Gilbert, Phillip Clyde Park
Hartman, Wm. Greycliff
Hardgrove, Everett Stearns
Hall, Earl Gardiner
Hogan, Elsie Musselshell
Kirby, Noah Gebo
Norman, Frank Belgrade
Pope, Harold, ...Glendive
Smith, Fred, ...Bloomington, Wis.
Sumner, Fred Clyde Park
Shriver, Frank Ennis
Waters, Rena Butte
White, Kittie.....Bozeman
—28

SECOND YEAR.

Anderson, Hilda Bozeman
Anderson, Ruth Bozeman
Baker, Raymond Bozeman
Bancroft, Clark, ...Oakley, Kan.
Behringer, Grace Bozeman
Berg, Ina Lennep
Bole, Margaret Bozeman
Brooke, Thomas Bozeman
Brown, Everett Bozeman
Buford, Luther Virginia City
Crouch, Leslie.....Great Falls
Cummings, Claude Bozeman
Greene, James Greene
Griffith, Gilbert Gebo
Guiler, William Laurel
Hartman, Thomas.....Reed's Point
Hauswirth, Herbert Anaconda
Hogan, Norman Musselshell
Jackson, Ernest Harrison
Keeler, Howard Twin Bridges
Kennedy, Everett Harlem
Kirk, Howard Bozeman
Kountz, Frank Bozeman
Kruse, Jacob Bozeman
Labrie, Tilford Harlowton
Lewis, Arlene Dewey
Lewis, Glenn Dewey
Madison, Cora Absarokee
Martin, Claude Stockett
McGuire, Frank Shannon
Messner, Valine Utica
Moger, Fred Bozeman
Nordquist, Joe Bozeman
Penwell, Jean Belgrade
Rich, Eliza....Hunter's Hot Springs
Slayton, Lydia Lavina
Spain, Roy Bozeman
Spaulding, George Salesville
Tannatt, Hazel Bozeman
Uhl, Charles Livingston
Van Aiken, Roxine, ...Bozeman
Van Camp, Alfred Two Dot
Van Camp, Ethel Two Dot
Vaughan, Walter Augusta
Walker, Arthur Fort Benton
Willson, Glenn Bozeman
Wilson, Nicholas Bozeman
Winter, Nelia Bozeman
—48

THIRD YEAR.

Baker, Lulu Bozeman
Bancroft, Ross Oakley, Kan.
Buford, Walter.....Virginia City
Clark, Olive....Hunter's Hot Springs
Cook, Fred Chouteau
Dick, Edwin Rimini
Dusenberry, Fay Bozeman
Dusenberry, Inez Bozeman
Fisher, Wallace Bozeman
Green, Jesse Manhattan
Guest, Elmer Jardine
Kimpton, Mittie Radersburg
King, John Fort Benton
Landon, Clifford.....Manhattan
Lewis, Clara Clara
MacIntosh, Ruth.....Olney, Col.
McCraw, John Bozeman
Messner, Zella Utica
Perrinne, Carlotta.....Utica
Phillips, Bessie Utica
Shellenberger, Marguerite, Willow Ck.
Slayton, Dan Lavina
Temple, Leslie Radersburg
Williams, E. W.....Radersburg
Willson, Walter Bozeman
Woolsey, Mary McLeod
Wohlfrom, Earl.....Canyon Creek
—27

IRREGULAR.

Benepe, Genevieve Bozeman
Brown, Joe T. Birney
Conard, Blanche.....Bozeman
Patterson, Vida Bozeman
Sheill, Helen, ...Straw
Ward, LeRoy Bozeman
—6

ONE YEAR HOME SCIENCE.

Armstrong, Vina Bozeman
Arnold, Josephine M. Bozeman
Boulton, Mrs. H. W. Bozeman
Brewer, Nellie G. Gordon, Neb.
Dishno, Laura O.....Jackson
Ferguson, Stella G.....Bozeman
Herr, Coral Dillon
Hickey, Lillian G.....Butte
Holland, Anna Joliet
Johnson, Johanna..... Bozeman
Kane, Alma G.....Bozeman
Steele, Carrie B.....Billings
Tande, Anna H.....Scobey
Voell, Leona T. Butte
Wild, Maud C...White Sulphur Spgs.
—15

STEAM ENGINEERING AND MACHINE SHOPS.

SECOND YEAR.

Chan, Adolph E.....Lewistown
Gerdts, August.....Deer Lodge
Lockridge, Torrence Stevensville
Papendick, Arthur Kalispell
Sleeman, Elmer Stevensville
—5

FIRST YEAR.

Berg, Oswald J,.....Lennep
Gotleib, Peter Howie
Hall, Arthur W.. Gardiner
Heebe, Buell, ...Bozeman
Jensen, Harry J. Helmville
Jones, Ralph P. Bozeman
Kent, Bert Bozeman
Linker, James H. Storrs
Moore. Ernest J. Chouteau
Moore, R. S. Melville
Murphy, R. M. Utica
O'Connell, W. T. Marysville
White, E. C. Bozeman
Wohlfrom, Earl.....Canyon Creek
—14

SCHOOL OF AGRICULTURE.

SECOND YEAR.

Blessing, John Norris
Calk, James C.,....Mt. Sterling, Ky.
Hammond, C. Boyd.....Helena
Keene, Guy.... Canton
Madsen, M. P. Denmark
Parchen, Ruehling Helena
Wilcox, Willis Conrad
—7

FIRST YEAR.

Blessing, Adolph Norris
Bielenberg, Claude E. Deer Lodge
Daniels, Chares E. Canton
Dawson, Harry Bozeman
English, Herbert E. Big Sandy
Gilchrist, Edgar Belgrade
Griffith, Roscoe Bozeman
Hansen, Philip.....Big Timber
Jackson, Joel Harrison
Lewis, W. A. Clara
Lewis, A. L. Clara
Leinard, Ford B. Cut Bank
Taylor, Fred Bozeman
Wells, Robert Canton
Work, Lester..... Bozeman
—15

CREAMERY COURSE.

Brook, Glenn Avon
Carter, Fred.....Great Falls
Hogan, Charles B.....Musselshell
Loquet, Paul..... Avon
—4

SHORT AGRICULTURAL COURSES.

Armstrong, George H.....Miles City
Ayres, W. S. McLeod
Bade, L. C. Big Timber
Bompart, J. L. Helena
Border, J. D., R.F.D 2.....Bozeman
Border, Mrs. A. M., R.F.D. 2 Bozeman
Burmeister, Fred D. Miles City
Conrow, C. G. Belgrade
Coulter, W. D.....Meyersburg
Decker, Lacy Bozeman
Decker, N. A. Bozeman
Decker, Mrs. N. A.....Bozeman
Gibbs, J. T., R.F.D. 2,.....Bozeman
Gibbs, Mrs. J. T., R.F.D. 2..Bozeman
Jones, George T., R. F. D. 3, Bozeman
Keyes, James E. Helena
Kinney, Mrs. E. C.....Bozeman
Martin, G. D. Big Elk
Martin, Lester.....Twin Bridges
Moore, George Bozeman
Oldaker, J. A.....Bozeman
Peterson, R. L., ...Sedan
Richli, R. C., ...Missoula
Roth, Wm., R. F. D. 2....Bozeman
Roth, M. A., R.F.D. 2.....Bozeman
Wolfskill, J. M., R.F.D. 1,..Bozeman
Wolfskill, Mrs.J.M.,R.F.D. 1, Bozeman
Wylie, Robert Bozeman
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MUSIC SCHOOL.

PIANO.

Accola, Estelle Bozeman
Aldritt, Alice Bozeman
Alward, Coda..... ...Bozeman
Anderson, Ruth Bozeman
Bancroft, Alma Bozeman
Bromley, Mary Bozeman
Bromley, Claire Bozeman
Buford, Walter Virginia City
Buell, Vera,..... Bozeman
Catron, Pearl Bozeman
Clark, Olive Bozeman
Conley, Mrs. C. C.....Bozeman
Cruickschank, Mrs. Bozeman
*Cnningham, Glenn..... Bozeman
Feazelle, Grace Bozeman
Fisher, Helen Bozeman
Fiske, Gretchen Helena
Flager, Ruth Red Lodge
Fox, Hazel Bozeman
Fransham, Edna Bozeman
Fransham, Eugene..... Bozeman
Gray, Florence Bozeman
Gray, Helen Bozeman
Griffith, George..... Gebo
Harris, Vera Bozeman
Hartman, June Bozeman
Hartman, Leah Jeffers
Hensley, Lillian Castle
Linfield, Leila Bozeman
McCullough, Grace Gebo
McCullough, Florence Gebo
Maynard, Frances Jeffers
Metcalfe, Mollie A. Philipsburg
Metheny, Helen Bozeman
Miller, Mabel Bozeman
Moore, Merrill Bozeman
Morgan, Nannie Bozeman
Noble, Erma Bozeman
Perrine, Carlotta Utica
Phillips, Bessie Utica
Phillips, Elizabeth Lewistown
Phillips, Madeline Bozeman
Piedalue, Alice Bozeman
Ponsford, Mabel.... Bozeman
Quaw, Eugene..... Bozeman
Reynolds, Grace Bozeman
Sales, Zada Bozeman
Schumacher, Hettie Bozeman
Sears, Edith L. Bozeman
Settle, Ruby Bozeman
Settle, Ruth Bozeman
Shiell, Helen Straw
Small, Nora Manhattan
Stewart, Mildred Bozeman
Story, Clara Park City
Story, Katherine.....Park City

Hollier, Alice Bozeman
Hollier, Georgia Bozeman
Jackson, Grace Harrison
Kane, Alma Bozeman
King, Gladys Bozeman
Kirschner, Hortense Bozeman
Lehrkind, Matilda Bozeman
Lewis, Arlene Dewey
Lewis, Louise Dewey
Linfield, Azalea Bozeman

*Deceased.

Streit, Minnie.....Dillon
Switzer, Madge Bozeman
Thorne, Florence.....Bozeman
Van Camp, Mary.....Two Dot
Voell, Leona Butte
Vreeland, Edna Bozeman
Waters, Rena Ranch
White, Earl Bozeman
Wild, Maud..White Sulphur Springs
Wilson, Elva Bozeman
Ziles, Mrs. Homer.....Bozeman
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VOCAL.

Anderson, Vera.....Bozeman
Bancroft, Ross.....Oakley, Kan.
Benepe, Genevieve Bozeman
Behringer, Grace Bozeman
Bromley, Earl Bozeman
Brammer, Vergie Bozeman
Buell, Grace Bozeman
Conley, Mrs. C. C.....Bozeman
Damerel, Cora Bozeman
Delaney, Dr. Joseph.....Bozeman
Elliott, Mrs. W. J.....Bozeman
Hartman, June Bozeman
Hansen, Anna Bozeman
Kittams, S. A. Straw
Lewis, Arlene Dewey
Lovelace, Amy Bozeman
Miller, Mary.....Miles City
Niles, Eunice Bozeman
Phillips, Elizabeth.....Lewistown
Robinson, J. Fred Bozeman
Widener, Carl C. Bozeman
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VIOLIN.

Berg, Oswald Lennep
Calkins, Ethel.....Cody, Wyo.
Davidson, Paul Bozeman
Griffith, George Gebo
Kinney, Martha Bozeman
Throm, Will Helena
Tschudy, Montana..... Billings
Wilkins, Earl C. Pony
Willson, Herman Bozeman
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Names repeated	49
NET TOTAL	419

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Bulletin of THE MONTANA STATE COLLEGE OF AGRICULTURE *and* MECHANIC ARTS.

FOUNDED EIGHTEEN HUNDRED NINETY-THREE

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Sixteenth

Annual Catalogue

Montana

State College of Agriculture

and Mechanic Arts

1908-1909.

Printed in office of Republican-Courier,
Bozeman, Montana.



Calendar

1909

Second Semester Begins.....8:30 A. M., Monday, Feb. 1
Lincoln's Birthday, a Holiday.....Friday, Feb. 12.
Washington's Birthday, a Holiday Monday, Feb. 22.
School of Agriculture Ends.....Friday, April 2.
Arbor Day, a Holiday..... Tuesday, May 11.
Decoration Day, a Holiday.....Sunday, May 30.
Examinations Begin.....9:00 A. M., Monday, May 31.
Baccalaureate Address..... Sunday, June 6.
Music Recital..... Monday, June 7.
Alumni Banquet.....P. M., Wednesday, June 9.
Commencement Day..... Wednesday, June 9.
Registration and Examination for Entrance and Conditions,
.....Monday and Tuesday, Sept. 13 and 14.
First Semester Begins.....8:30 A. M., Wednesday, Sept. 15.
Columbus Day, a Holiday..... Tuesday, Oct. 12.
School of Agriculture Begins.....Tuesday, Oct. 19.
Thanksgiving Recess Begins.....Thursday, Nov. 25
Winter Vacation Begins..... Saturday, Dec. 18.

1910

Winter Vacation Ends.....8:30 A. M., Tuesday, Jan. 4.
Examinations Begin..... 9:00 A. M., Monday, Jan. 24.
First Semester Ends..... Saturday, Jan. 29.
Second Semester Begins 8:30 A. M., Monday, Jan. 31.
Lincoln's Birthday, a Holiday.....Thursday, Feb. 12.
Washington's Birthday, a Holiday Tuesday,Feb. 22.
School of Agriculture Ends..... Friday, April 1.
Arbor Day, a Holiday..... Tuesday, May 10.
Decoration Day, a Holiday.....Monday, May 30.
Examinations Begins.....9:00 A. M., Tuesday, May 31
Baccalaureate Address.....Sunday, June 5.
Music Recital..... Monday, June 6.
Preparatory Department Graduation Tuesday, June 7.
Alumni Banquet..... P. M., Wednesday, June 8.
Commencement Day..... Wednesday, June 8.

Montana State Board of Education

GOVERNOR EDWIN NORRIS, (ex-officio) Chairman.....Helena.
ATTORNEY GENERAL ALBERT J. GALEN, (ex-officio).....Helena.
STATE SUPT. W. E. HARMON, (ex-officio) Secretary.....Helena.

By Appointment.

G. T. PAUL.....Dillon.
H. G. PICKETT.....Helena.
(Term expires February 1, 1909.)
JOHN M. EVANS.....Missoula.
CHARLES R. LEONARD.....Butte
(Term expires February 1, 1910.)
O. W. McCONNELL.....Helena
E. O. BUSENBURG.....Lewistown
(Term expires February 1, 1911.)
O. P. CHISHOLM.....Bozeman.
S. D. LARGENT.....Great Falls.
(Term expires February 1, 1912.)
B. T. HATHAWAY, Clerk of the Board.....Helena.

Executive Board

In Charge of the College and Experiment Station.

PRESIDENT JAMES M. HAMILTON, (ex-officio) Chairman..Bozeman.

By Appointment.

WALTER S. HARTMAN.....Bozeman.
(Term expires April 1913.)
J. H. BAKER.....Bozeman.
(Term expires April, 1911.)
GEORGE COX, Secretary-Treasurer.....Bozeman.

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Faculty

JAMES M. HAMILTON, M. S., (Union Christian College) President.
Professor of Philosophy and Economics.

Mrs. F. E. MARSHALL.
Professor of Art.

WILLIAM F. BREWER, A. M., (Harvard University).
Professor of English and Latin.

AARON H. CURRIER, A. M., (Oberlin College).
Professor of French and German.

MISS LILLA A. HARKINS, M. S., (South Dakota Agricultural College.)
Professor of Domestic Science.

ROBERT A. COOLEY, B. S., (Massachusetts Agricultural College.)
Professor of Zoology and Entomology.

WILLIAM D. TALLMAN, B. S., (University of Wisconsin.)
Professor of Mathematics.

FREDERIC B. LINFIELD, B. S. A., (Ontario Agricultural College.)
Professor of Agriculture.

WILLIAM M. COBLEIGH, A. M., (Columbia University).
Professor of Chemistry.

JOSEPH A. THALER, E. E., (University of Minnesota).
Professor of Electrical Engineering.

GEORGE B. COUPER, M. E., (University of Minnesota).
Professor of Mechanical Engineering.

E. TAPPAN TANNATT, B. S., (Washington State College).
Professor of Civil Engineering.

WILLIAM J. ELLIOTT, B. S. A., (Ontario Agricultural College).
Professor of Dairying and Principal of the School of Agriculture.

ALFRED ATKINSON, B. S. A., (Iowa State College).
Professor of Agronomy.

ROY W. FISHER, B. S., (University of Idaho).
Professor of Horticulture.

ROBERT W. CLARK, B. S. A., (University of Minnesota).
Professor of Animal Industry.

CHARLES S. DEARBORN, B. S., (Kansas State Agricultural College).
Associate Professor of Mechanical Engineering.

DEANE B. SWINGLE, M. S., (University of Wisconsin).
Assistant Professor of Botany and Bacteriology.

ROBERT D. KNEALE, C. E., (Purdue University).
Assistant Professor of Civil Engineering.

M. HERRICK SPAULDING, A. M., (Leland Stanford Jr., University.)
Assistant Professor of Zoology.

MISS HELEN R. BREWER, A. B., (Iowa College).
Assistant Professor of History and Latin.

MISS MARY A. CANTWELL.
Principal of the Preparatory School and
Instructor in English and Mathematics.

JOHN H. McINTOSH, B. L., (University of Georgia).
Director of Athletics and Instructor in Physical Training.

MRS. MABEL KINNEY HALL, Ph. B., (Oberlin College).
Instructor in Public Speaking and Modern Languages.

MISS FLORENCE BALLINGER,
Instructor in Sewing.

FRANK W. HAM, M. S., (Montana Agricultural College).
Instructor in Physics.

CHARLES E. MOLLETT, Ph. C., (University of Kansas).
Instructor in Pharmacy.

FRANK C. SNOW, B. S., (Ohio State University).
Instructor in Civil Engineering.

WALTER W. CARLSON, B. S., (Kansas State Agricultural College).
Instructor in Mechanical Engineering.

WILLIAM F. SCHOPPE, B. S., (University of Maine).
Instructor in Poultry.

MRS. EDNA GAGE,
Assistant in Art.

MISS FRIEDA BULL, B. S., (Montana Agricultural College).
Assistant in Mathematics and Physics.

J. WILBUR ROBINSON, B. S., (Montana Agricultural College).
Assistant in Chemistry.

MISS LUCILE BREWER,
Assistant in Cooking.

F. ARTHUR OLIVER, (Toronto Conservatory).
Director of the School of Music and
Instructor in Piano.

MISS REGINA BARNES, (Wooster Conservatory).
Instructor in Piano.

MISS HELENA J. WALTER, (Cincinnati Conservatory).
Instructor in Vocal Music.

GEORGE W. HEY., Mus. Bac., (Syracuse University.)
Instructor in Violin.

LOUIS L. HOWARD,
Band Instructor.

MRS. MARY K. WINTER,
Librarian.

GEORGE R. CALLAWAY,
Secretary and Accountant.

STANDING COMMITTEES.

AGRICULTURE—Atkinson, Cooley, Fisher, Elliott, Clark.
ASSEMBLY—Ham, Mrs. Hall, Oliver.
ATHLETICS—McIntosh, Currier, Swingle.
BUILDINGS—Tannatt, Clark, Mollett.
COMMENCEMENT—Miss Brewer, Miss Cantwell, Oliver.
ENGINEERING—Thaler, Couper, Tannatt, Dearborn, Kneale.
LIBRARY—Hamilton, Cobleigh, Thaler.
PUBLICATIONS—Brewer, Swingle, Kneale.
REGISTRATION—Currier, Miss Brewer, Ham.
SCHEDULE—Tallman, Miss Cantwell, Couper.
SCIENCE—Cobleigh, Tallman, Brewer, Cooley, Miss Harkins.
STUDENT AID—Elliott, Miss Harkins, Miss Cantwell, Mollett, Dearborn.
STUDENT ORGANIZATIONS—Mrs. Hall, Currier, Atkinson, Miss Brewer, Spaulding.

The Agricultural Experiment Station

STATION STAFF.

F. B. LINFIELD, B. S. A., Director.
R. A. COOLEY, B. S., Entomologist.
R. W. FISHER, B. S., Horticulturist.
E. TAPPAN TANNATT, B. S., Rural Engineer.
W. J. ELLIOTT, B. S. A., Dairyman.
ALFRED ATKINSON, B. S. A., Agronomist.
ROBERT W. CLARK, B. S. A., Animal Industry.
EDMUND BURKE, B. S., Chemist.
DEANE B. SWINGLE, M. S., Assistant Botanist and Bacterioligst.
J. B. NELSON, Sup't. Dry Farm Work.
H. O. BUCKMAN, M. S., Assistant Agronomist.
R. D. KNEALE, C. E., Assistant Engineer.
REUBEN M. PINCKNEY, B. S., A. M., Assistant Chemist.

In connection with the college, the Montana Agricultural Experiment Station is conducted. The object of this station is to further the interests of the agricultural industries of the State of Montana. This is done by conducting researches and experiments which may include the physiology of plants and animals; the diseases to which they are severally subject, with remedies for the same; the chemical composition of useful plants at their various stages of growth; the various subjects connected with irrigation; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants

or trees for acclimation; the analysis of soil and water; the chemical composition of manures, natural and artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly upon the agricultural industry of Montana as may seem advisable.

The experiment station farm, consisting of 380 acres, adjoins the college grounds. It is provided with the necessary barn, granaries, tool houses, farm implements, live stock, gardens, greenhouses and orchards.

Sub-stations for experimental work in dry farming are maintained in various parts of the state and are conducted in co-operation with the railroads and the United States Department of Agriculture. A sub-station for experiments in horticulture has been established in the western part of the state.

The Montana Experiment Station is supported by the annual appropriations from the Federal government under the Hatch and Adams Acts, supplemented by growing appropriations from the state.

The station issues during the year a series of bulletins, which put in practical form the results of the experimental work. These are sent, upon request, to any citizen of Montana who will apply for them, and any such may have his name entered upon a mailing list, and receive all bulletins as soon as issued.

Address Director Experiment Station, Bozeman, Montana.



Farm and College Buildings from the West.

The College of Agriculture and Mechanic Arts.

AIM AND SCOPE.

The purpose of the colleges of agriculture and mechanic arts is chiefly to provide industrial education in agriculture, engineering, household economy, and applied science, for the young men and women of the respective states in which they are located. The scope of the Montana Agricultural College is set forth in the two so-called Morrill Acts of Congress, which authorized this class of institutions and supplied in part endowment and funds for maintenance; and in an Act of the Montana Legislature accepting the land and money grants from the national government.

The first Morrill Act of Congress of July 2, 1862, making a land grant for the partial endowment of the agricultural and mechanical colleges states that the income from these lands shall be used to maintain colleges "where the leading object shall be, without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

The second Morrill Act of Congress, August 30, 1890, making an annual appropriation out of the treasury of the United States for the further support and endowment of these colleges, provides that this fund is "to be applied only to instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural and economic sciences with special reference to their application to the industries of life; and to the facilities for such instruction."

The Act of the Montana Legislature, approved February 16, 1893, accepts these grants of lands and money and states that the Montana Agricultural College shall have for its object "instruction and education in the English language, literature, and mathematics, civil and mechanical engineering, agricultural chemistry, animal and vegetable anatomy and physiology, the veterinary art, entomology, geology and such other natural sciences as may be prescribed by the State Board of Education; political, rural and household economy, agriculture, horticulture, history, bookkeeping and especially the application of science and the mechanical arts to practical agriculture in the field, and irrigation and the use of water for agricultural purposes."

ENDOWMENT.

The Enabling Act, providing for the admission of Montana into the Union, approved February 22, 1889, Sec. 16, grants 90,000 acres of land to Montana for the use and support of an agricultural college according to the terms of the Act of Congress, July 2, 1862, and Sec. 17, grants



COLLEGE HALL.



AGRICULTURAL HALL.

an additional 50,000 for the same purposes, and subject to the same conditions and limitations as the other grant. The 140,000 acres of land cannot be sold at a price less than $10.00 per acre, and the principal, together with all money received from the sale of timber, invested as a permanent endowment. The unsold lands may be leased and the rentals together with the interest on the permanent endowment shall be used for the maintenance of the college.

The Act of Congress of August 30, 1890, appropriates $25,000 annually out of the treasury of the United States. By the Nelson bill, passed March 3, 1907, this amount is increased annually by $5,000 each year, beginning in 1907, until the total annual appropriation shall reach $50,000, at which figure it shall remain.

Both the Acts of July 2, 1862, and August 30, 1890, contain this clause: "No portion of the funds, nor the interest thereon, shall be applied, directly or indirectly, under any pretense whatever, to the purchase, erection, preservation, or repair of any building, or buildings." The State must appropriate money for the following purposes: Buildings, repairs, furniture, fuel, light, water, insurance, printing, salary of all the employes other than the faculty, and the administrative expenses.

LOCATION.

Bozeman, the county seat of Gallatin county, is on the main line of the Northern Pacific railroad. For convenience, healthfulness and beauty of surroundings, the location is unsurpassed. The college is situated on an elevation which commands a view of one of the most fertile valleys in the world, covered far and wide with grain fields and hemmed in on all sides by lofty mountains.

Bozeman is a city of homes and churches, with a wholesome moral environment. It is a most desirable residence city for families who wish to educate their children. Expenses are moderate and there are all the conveniences of a modern city. The college is reached from the railroad station and the city by street car.

CAMPUS AND FARM.

The grounds and farm contain three hundred and eighty acres. Forty acres in the immediate vicinity of the buildings constitute the campus and recreation grounds, which are in lawn, interspersed with flower beds, shrubbery, trees and driveways. The remainder is used for farming and experimental purposes.

BUILDINGS.

College Hall, situated in the center of the college campus is a substantial structure of brick and stone of practically fire proof construction, having a total length of one hundred and twenty-eight feet and a width

of ninety feet. It is three stories high, and has a basement, which furnishes quarters for mechanical drawing and three class rooms. The first floor contains the library, two offices, a reception room and three large class rooms. The north half of the second floor is devoted to the art department, the arrangement being such that three large rooms can be thrown together, by sliding doors, for exhibition purposes. The south half of the second floor is used by the department of civil engineering and irrigation, and has two offices, two recitation rooms and a drawing room. The third floor contains the large assembly hall, a literary hall and five class and music rooms.

Agricultural Hall is a three story building, one hundred and fifty feet by sixty-eight feet, pressed brick, tile roof, maple floors and modern equipment throughout. The north half of the first floor contains the quarters for dairying, consisting of storerooms, office, class room, butter and cheese rooms and laboratories. The south half of this floor is used for horticulture and has seed room, office, class room, work room and laboratory. The north half of the second floor is occupied by the agronomy department with office, class room, dry land office and soil and grain laboratories. In the south half are offices for the director of the experiment station, superintendent of farmers' institutes, class room, office and laboratory for the department of animal industry. The third floor is devoted to domestic science and contains two large kitchens, two dining rooms, two class rooms, sewing rooms, offices and parlor.

The Chemistry and Physics Building is located west of College Hall. It is sixty by one hundred feet, of pressed brick, and is three stories high including the basement. The basement is occupied by the physics lecture room, pharmacy lecture room and laboratory, the mineralogical and assay laboratory and the museum of geology and mineralogy. The main floor is occupied by the office and department library, a lecture room, a preparation room, and the experiment station laboratory. The east half of the second story contains the laboratories for physics, and the west half, the qualitative and the quantitative laboratories. The north tower is used for the meteorological obseratory, and a fine set of registering instruments is installed in it.

The Biology Building, consisting of three stories and basement, is brick veneered. On the top floor is a lecture room and a museum containing the zoological collections. On the floor below are three laboratories for bacteriology, botany and zoology, and an office and work room for the botanist. The west half of the first floor is a large laboratory for general biology and the east half is occupied by the office, library, and work room for the entomologist. The basement contains work rooms, class room, store rooms, herbarium room and dark room. Attached to this building on the south is a greenhouse, 50 by 36 feet, for botanical purposes, and an insectary, 18 by 10 feet, for the study of living insects.

The Engineering Laboratory is a two story stone building, 55 by 33

feet, with a frame annex 36 feet by 20 feet. The first floor contains the dynamos, motors, two steam engines and strength of material testing machines. The second story is occupied by the storage battery, photometer and electric light rooms, class room and the office of the professor of electrical engineering. The first floor of the annex contains the cement laboratories, and the second floor is used for electrical designing.

The Shop Building is a one story frame structure, 60 by 100 feet, with an annex 36 by 50 feet. It contains a forge room and foundry, 27 by 60 feet, a machine shop, 44 by 72 feet, an office, a wash room and a tool room. The wood shop is in the annex. Nearby stands a small building for the traction engines.

The Power House is a brick structure, 32 by 76 feet, centrally located with reference to the principal college buildings. It contains an eighty horse-power tubular boiler, a one hundred and twenty-five horse-power Root water-tube boiler, a sixty horse-power engine, directly connected with a forty K. W. commercial dynamo, and coal storage bins. The engine and generator furnish power for electric lights, the ventilating fans, the shop and laboratory machinery.

The Gymnasium is a frame building, 100 by 60 feet, with two rooms each 14 by 12 feet on the south end, fitted with shower and needle baths. This building is heated and lighted and has a good floor for gymnasium work. In the south end are two dressing rooms, each 28 by 12 feet. Along each side is a set of four rows of permanent seats, amphitheater style. The hall furnishes a convenient place for gymnasium practice, basket ball and other indoor athletics.

The Cattle Barn is a two story frame building, 120 by 86 feet, and of fine architectural appearance. On the first floor is the dairy stable, quarters for young stock, a stock judging room, 40 by 40 feet, box stalls, feed bins and offices. The second story is used for storage of hay. All stables have cement floors and iron stalls.

The Veterinary Building is a two-story frame structure, 25 by 40 feet, with a one story wing 20 by 40 feet. On the first floor are the office of the veterinarian, a laboratory and a work room. The second floor contains a laboratory and a class room.

The Horse Barn is a two story frame building, 86 by 44 feet. It contains a living room, carriage room, feed bins, fourteen single stalls, three double box stalls, and space for 100 tons of hay.

The Seed Barn and Granary is a two story building and affords ample storage room for the field crops on the station farm.

The Piggery consists of a main building, 30 by 35 feet, with two wings, 16 by 50 feet each. In the main building are the feeding rooms and slaughter room, while the wings provide six pens each, for the hogs.

The Poultry Plant consists of two buildings. The first is 122 feet long by 15 feet wide. In the center is an office and feed room, under which is the incubator cellar and heating plant. One wing is a brooder

house, the other contains six pens, with yards 100 feet long on either side. The other building is 120 feet long and contains eight pens with yards.

The Station Heating Plant is a neat brick structure just west of the biology building, which furnishes the steam for the adjacent buildings.

EXPENSES.

There are no dormitories connected with the college. Students find room and board in private families convenient to the college at from $18.00 to $22.00 per month. A list of approved places with prices and accommodations is kept in the president's office. A committee of students meets all trains on registration days and at other times on request, and aids in finding satisfactory locations. The total college expense for the year for tuition, room, board, books and incidental expenses may be estimated at $200 to $300.

EMPLOYMENT FOR STUDENTS.

A number of students earn a part of their expenses while in college. Students expecting to work their way should come with sufficient money to pay their expenses for one semester unless they have engaged work in advance. The college cannot guarantee employment, but those who are willing to give efficient, faithful service have usually found work.

A few students are employed as janitors and as assistants in the shops, laboratories, and barns. Others care for furnaces, horses and cows in the city, work in stores and at various kinds of house work. Calls for young lady students to work for their board are numerous.

Students readily find employment at profitable wages during the summer vacation. A large number annually get work with the transportation companies in the Yellowstone National Park as drivers, camp attendants and domestics. Engineering students are placed with the reclamation service, the railroads, and the electric power plants.

A faculty committee aids students to find employment. Those desiring work should write, stating experience and kind of work desired.

FEES.

1.—Annual matriculation fee for college, preparatory, pharmacy, art and one year home science course $12.00
2.—Annual matriculation fee for school of agriculture..... 6.00
3.—Annual matriculation fee for four weeks course in dairying and short agricultural courses 2.00

DEPOSITS.

Agriculture.—Agron. (3); Dairy (1), (2), (a), or (c) per semester	$ 2.00
Art.—Art (1), (2), (3), (4), (5), (6), (7), (8), (a), or (b) per semester	1.00
Art (9) per semester	5.00
Biology.—Biol. (a) or (b) per semester	1.00
Biol. (1), (2), (4), (6), (9), (15), (16), (c), or (d) per semester	1.50
Biol. (3), (10), (11), or (13) per semester	3.00
Biol. (12) per semester	4.00
Chemistry.—Chem. (1) per year	8.00
Chem. (a) per year	3.00
Chem. (6) per semester	2.00
Chem. (2), (3), (4), (7), (10), or (11) per semester	6.00
Chem. (12) per semester	25.00
Engineering.—C. E. (1a), (4a), (11), (15), (17), or (20) per year	1.50
C. E. (29) per semester	1.00
C. E. (31) per semester	5.00
E. E. (4), (6), (10) or (12) per semester	3.50
M. E. (14) or (15a) per semester	1.00
M. E. (20) per semester	3.50
M. E. (2), (6), (9), (12), (17), (21), or (27) per year	6.00
M. E. (a), (b), (c), (d), (e), (f), (g), or (h) per year	4.00
Home Science.—H. S. (1), (3), (5), (6), (a), (b), or (g), per year	3.00
H. S. (11), (12), (13), (14), (15), (c), (d), or (h) per year	.50
Physics.—Phys. (1a), (2), (4), (6), or (7) per year	1.00
Pharmacy.—Phar. (4), (5), or (6) per semester	2.00
Phar. (9) per semester	4.00
Phar. (7) or (11) per semester	6.00
Phar. (3) per semester	10.00

A fee is a fixed charge and no part of the fee is returned to the student. The deposits in most cases are intended to cover the cost of materials and breakage of equipment in the laboratory and any balance of the deposit not required for this purpose is returned to the student at the close of the semester or year.

ADMISSION.

Admission to the freshman class, in any of the college courses, is granted: (a) By a certificate of graduation from an accredited high school, (b) By examination in the subjects required by the college for entrance, (c) By faculty approval of grades from other than accredited high schools, (d) By graduation from the preparatory school.

Candidates for admission to the preparatory school, the one year course in domestic science and the school of agriculture, must have com-

pleted the eighth grade in the public schools or its equivalent. One year of high school work is required for admission to the school of pharmacy. There are no set requirements for art, music and the short agricultural courses, all being admitted who give evidence of being able to profit by the work. All candidates for admission to the institution in any department whatever are required to present the requisite diplomas or certificates for work previously done in other schools and no registration is complete until such credentials are presented and passed upon.

ENTRANCE REQUIREMENTS.

Fifteen units are required for admission to the freshman class in any college course.

Any one with not less than thirteen units may be admitted conditionally, but the units of preparatory work which have not been offered at entrance must be given preference over college subjects.

A unit for adminssion shall consist of work to the amount of five recitations periods per week of forty-five minutes each, or of four recitation periods per week of sixty minutes each, for a year of not less than thirty-six weeks.

Two periods of laboratory, shop work, or drawing shall count as one recitation.

The following seven units are required of all applicants:

English 3	Mathematics 3
Physics 1	

The remaining eight units shall be presented from the following list:

English.....1	General History 1 or 2
German.....2 or 3	English History 1
French 2 or 3	American History 1
Latin 2, 3 or 4	Freehand Drawing 1
Biology, or Botany, or Zoology.. 1	Agriculture 1 or 2
Trigonometry ½	Mechanical Drawing 1
Physiology ½	Shop Work.. 1 or 2
Phys. Geography ½	Home Science 1 or 2
Chemistry 1	

REGISTRATION.

Registration and Assignment of Work.—All students are registered in the president's office, and each one is then assigned to a member of the faculty, called a class officer. The class officers arrange the studies and it is their duty to advise with the students regarding all questions which arise in connection with their studies and to investigate complaints of unsatisfactory work. Students should consult with the class officers when in need of assistance or information.

Unless permission is granted by the faculty, class officers will register all students in accordance with the rules governing prerequisites, failures, and number of credits. The registration committee will examine all credentials for admission, and all grades earned in this and other in-

stitutions and report any irregularities in registration to the faculty. No registration shall be considered final until approved by the committee or the faculty.

Amount and Regularity of Work.—Students under twenty-one years of age will be admitted only to regular courses or to work as nearly regular as their preparation allows, unless on special action of the faculty. Students over twenty-one will be admitted to such work, not less than twelve credits, (allowance being made for music) as the schedule permits and their class officers approve.

Change of Registration.—A student desiring to change his studies will present his request to his class officer, who, after consulting all teachers interested, will take such action as he may deem best. Change in registration will be made after four weeks for extraordinary reasons only. Requests for change in registration will not be considered during the last eight weeks of a semester.

A change in course of study is allowed by a vote of the faculty only.

ATTENDANCE.

Attendance—A student tardy or absent from any class will present the reason for the tardiness or absence at the first appearance at such class after the tardiness or absence occurred. The teacher will be the judge of the sufficiency of the excuse. A student absent from class the third consecutive time will be reported to the class officer and the president. A student who has been three times absent (two tardiness counting as one absence) and is unable to present a satisfactory excuse is immediately suspended and will be reinstated only by a vote of the faculty.

Leave of Absence—When it is necessary for a student to be absent from the city application must be made to the president for leave of absence. A leave of absence is a justification for absence from class but does not give relief from the work omitted.

GRADES.

Passing Grades—An average standing from 90 to 100 is A, from 80 to 90 is B, from 70 to 80 is C, from 60 to 70 is D.

All students, one half of whose work shall have received the grade of A will be recommended for the degree "With Honors."

Conditions and Failures—An average standing of less than fifty per cent for any semester's work shall be termed a "failure," and the work must be made up by repeating the subject the following year. An average standing for the semester of more than fifty per cent and less than sixty per cent shall be termed a "condition." A condition must be removed by a special examination before the beginning of the semester in which the subject is next taught. If not removed within this limit the condition shall become a failure, to be made up by immediately repeating the subject. Examinations for removing conditions shall be held on

the Monday and Tuesday preceding the beginning of the college year, and on the last Friday and Saturday of each semester, and at no other time. Laboratory work falling below the grade in quality or quantity shall be marked deficient and shall be made up within the same time limit as conditions.

Students whose work is unsatisfactory will be reported to the class officer and the president, and information will be sent to the parents or guardians.

Credits—For convenience in estimating the requirements for a degree, the following rules are laid down: One hour a week, for a semester, of recitation or lecture work, or two and one-half hours a week, for a semester, of laboratory, shop, library work, or drawing, shall count, as one credit.

If for any reason the full time is not occupied in the shop, laboratory, drawing room, or library, the remainder shall be used under the supervision of the instructor for outside work.

No regular student may take in any one semester work amounting to less than twelve credits, nor more than nineteen, unless a greater number are prescribed in the course.

Grades brought by a student from another institution will be accredited in this college only after personal conference with and approval by the head of the department in which credit is desired.

GRADUATION AND DEGREES.

Bachelor's Degree—Candidates for the bachelor's degree must complete satisfactorily one of the college courses as outlined and not less than 130 credits; including also a thesis, the value of which in credits shall be determined by the instructor concerned. Students who are relieved for any reason of the requirements in military drill shall present four additional credits in some other subjects.

The dergee of Bachelor of Science is conferred upon a student completing the work prescribed in any one of the college courses and the name of the course taken is placed on the diploma.

Master's Degree—The candidate must hold a bachelor's degree from this college or another of at least equal rank, and in the line of work for which he applies for the master's degree, or he shall have sufficient preparation in his major subject to enable him to carry on research work. He shall complete one full year of resident study of not less than 32 credits.

There shall be one major subject and one or two minors, the major being equal to 10 credits per semester. The plan of the work must be approved by the committee on graduate work by October 1. The candidate shall also present a thesis embodying the results of original research, which may be part of the credits required for the major subject.

Engineering Degrees.—On the completion of one year of post graduate work, or three years of professional work and the presentation of an



AGRICULTURAL SOCIETY.

HAMILTONIA SOCIETY



M. A. C. REGIMENTAL BAND.

acceptable thesis, the college will confer upon the holders of bachelors' degrees in the engineering courses the degrees respectively of Civil Engineer, Electrical Engineer, or Mechanical Engineer.

MISCELLANEOUS.

Government—Students are expected to conduct themselves as ladies and gentlemen; those who fail to comply with this demand will be requested to leave the institution.

Work for Exhibition—It is required that students who have done work suitable for exhibition purposes shall place such work at the disposal of the institution for the period of two years.

Assembly—Students are required to attend the weekly assembly, at which lectures are delivered by members of the faculty and others.

Student Organizations—All public performances, given by students or student organizations, using the name of the college, will be under the supervision of the committee on student organizations.

Military Drill—All male students, except aliens, those physically disquanfied, members of the junior and senior classes, and student assistants, are required to take military drill, satisfactory work being requisite for graduation.

Honorable Dismissal—Students intending to sever their connection with the institution, either indefinitely or permanently, should report as soon as possible to the president, either in person or in writing, giving proper explanation, and should apply for an honorable dismissal. Students leaving the institution without such honorable dismissal (except at the end of the college year) will not be re-admitted to the college at any later time, nor will any reports or grades in credit for work done here be sent out until satisfactory explanation is made.

ACCREDITED HIGH SCHOOLS.

Following is a list of the accredited high schools of the state:

(1) **City High Schools**—Anaconda, Billings, Butte, Chinook, Columbus, Forsyth, Fort Benton, Glasgow, Great Falls, Helena, and Whitehall.

(2) **County High Schools**—Beaverhead, Dillon; Broadwater, Townsend; Carbon, Red Lodge; Custer, Miles City; Dawson, Glendive; Fergus, Lewistown; Flathead, Kalispell; Gallatin, Bozeman; Granite, Philipsburg; Jefferson, Boulder; Missoula, Missoula; Park, Livingston; Powell, Deer Lodge; Sweet Grass, Big Timber: Teton, Chouteau.

COLLEGE ORGANIZATIONS.

Young Men's Christian Association—The association is undenominational and is well fitted to promote the moral and religious life of students. It conducts mission and Bible study courses, prayer meetings and

secures addresses by religious workers. The association promotes good fellowship by giving social entertainments, assists new students to get started in college life and aids in securing employment for those who wish to work their way through college.

Young Women's Christian Association—The object of this association is the all round development of Christian womanhood. It co-operates with the Y. M. C. A. in its social and religious work among the students. It conducts devotional meetings and carries on systematic Bible study. Several delegates are sent to the Northwestern Conference each year and an active interest is maintained in the state association.

Both associations have neatly furnished rooms in which to hold meetings and transact business.

Literary Societies—Three literary societies are maintained, the Arena for college young men, Hamiltonia for college young ladies and the Philomathion for preparatory students. Each society is in a flourishing condition, holding regular meetings. They give most excellent opportunity for practice in composition, declamation, oratory, debate and music.

Oratorical Association—This organization has charge of all declamatory, oratorical and debating contests, both between classes in the college and with the institutions that are comprised in the State Oratorical Association. All students are members of this association.

Engineering Society—This society admits as active members, all students in the regular college courses in engineering and as associate members, students taking engineering studies. The object is to increase interest in technical education by discussing the current questions and problems of the profession, and to aid its members financially by purchasing at wholesale rates, books, materials and instruments.

Agricultural Society—All agricultural students are eligible to membership in this society. Regular meetings are held for the discussion of topics of interest to students in agriculture. The aim is to create a professional interest in scientific agriculture with special reference to the possibilities of farm life.

The Exponent—A monthly publication, in magazine form, under this name, is maintained throughout the college year entirely under student supervision and control. The editor-in-chief is selected annually by the student body. He appoints the staff from among those students who have taken interest in the paper and been its best contributors. The Exponent is the organ of the students and contains literary, society, local, exchange and athletic departments.

Athletic Association—This association has general control of all athletic interests of the college, subject to the approval of the faculty. Base ball, basket ball, track and tennis are maintained. A part of the annual matriculation fee is appropriated to athletics and all students thus become members of this association without additional cost.

Branch of the American Institute of Electrical Engineers—A branch

of this society has been organized at the college. Regular monthly meetings are held, at which original papers are read or those of the Institute discussed. Students and teachers are kept in touch with practical engineers and their problems. Only regular members or student members of the American Institute are eligible to membership in this branch. There is, however, an Electrical Club which includes all the members of the Institute and all other students in the electrical engineering course.

College Band—The college band of forty-five members, under the instruction of Mr. Louis Howard, is one of the best amateur musical organizations in the state. The college provides instruments, music and instruction. The band is divided into two sections, beginners and experienced players. This gives a splendid opportunity both for those who have never played and those who have some skill in the use of instruments.

College Choristers—This glee club of twenty voices has attained a high degree of skill in rendering popular and high class music. The annual concert is one of the chief events of the college year. Professor F. Arthur Oliver is the conductor. A splendid opportunity is given students to cultivate their musical talent.

PRIZES.

Prize in Oratory—An annual prize of twenty dollars is given to the winner in the annual local oratorical contest. This is open to all students. The winner represents the college in the state oratorical contest.

Armstrong Prize in Declamation—Hon. F. K. Armstrong, of Bozeman, gives a prize of ten dollars for the winner of the annual declamatory contest of the preparatory school. There is also a second prize of five dollars. Only regular students are eligible.

Zenoleum Medal—The Zenoleum Company gives a medal to the winner in the local stock judging contest.

SCHOLARSHIPS.

The State Board of Education has established a four year scholarship in each of the accredited high schools for the student who receives the highest average grade in his class. These scholarships are awarded each year by the high school principals for their respective schools. This scholarship excuses the holder from paying any tuition or deposits. Any one winning a scholarship may choose any of the state institutions.

MILITARY DRILL.

The Act of Congress, July 2, 1862, makes military drill a requirement in all land grant colleges. The United States government details a regular army officer to each institution and furnishes the necessary equip- of guns and ammunition.

Military drill is required of all male students except members of the junior and senior classes and those physically disqualified. All stu-

dents taking drill are required to purchase the prescribed uniform. The cost of the uniform, including cap, is from $13.00 to $17.00, according to the quality of the cloth.

The uniforms are ordered by the college after the students register. Those expecting to take military drill should take this into consideration when purchasing clothing.

The names of the three cadets in the graduating class who have the highest grade of merit are reported to the war department for insertion in the U. S. Army Register. In making appointments from civil life to the regular or volunteer army, preference is given to those who have their names so recorded.

LIBRARY AND READING ROOM.

Public Depositary—By Act of Congress the library is now a depositary and receives all public documents and other printed matter issued by the United States government.

Main Library—The main library is in two large, well lighted rooms on the first floor of College Hall. The library contains 9926 volumes, not counting public documents, and about 6000 pamphlets. It is well supplied with standard works in technology, history, science and literature, as well as with dictionaries, cyclopedias and other reference works. About $1,500 is spent annually for books and periodicals.

Department Libraries—The agricultural library occupies two rooms on the second floor of Agricultural Hall. It contains almost complete bound sets of all state experiment station bulletins and United States Department of Agriculture publications, besides a large number of agricultural papers and standard works. One large room on the first floor of the biology building is used for the library and periodicals of the biological department. The library of the chemistry department is located in the office of the chemist in the chemistry building.

Periodicals—The following periodicals are on file in the reading rooms: American Blacksmith, American Chemical Journal, American Historical Review, American Housekeeper, American Homes and Gardens, American Journal of Anatomy, American Journal of Science, American Machinist, American Sheepbreeder, American Naturalist, American Veterinary Review, Analyst, Anatomischer Anzeiger, Annals of Botany, Annals of Mathematics, Annals of the American Society of Political Science, Atlantic Monthly, Berichte der Deutschen Chemischen Gesellschaft, Bon Ton, Boston Cooking School Magazine, Botanical Gazette, Botanisches Centralblatt, Breeder's Gazette, British Gardening, Bulletin of the Torrey Botanical Club, Biological Bulletin, Better Fruit, Canadian Entomologist, Cassier's Magazine, Cement Age, Cement World, Chemical Engineer, Century Magazine, Chemical News, Coast, Chicago Dairy Produce, Concrete Construction, Conservation, Craftsman, Country Life in America, Dairy Record, Delineator, Dial, Dietetic and Hygienic Gazette, Economic Geologist, Education,

Educational Review, Electrical World, Electrician (London), Electrical Review, Electrical Railway Journal, Electro Technische Zietschrift, Engineering Digest, Engineering Magazine, Engineering News, Engineering Record, Engineering Review, Engineering Contracting, Entomological News, Entomological Monthly, Every Day Housekeeping, Everybody's Magazine, Fliegende Blaetter, Farm Poultry, Forum, Foundry, Gardener's Chronicle, Good Housekeeping, Harper's Bazaar, Harper's Magazine, Harper's Weekly, Hoard's Dairyman, Home Needle Work Magazine, Illustration, Intercollegian, Irrigation Age, Jersey Bulletin, Journal of the Chemical Society (London), Journal of the New York Entomological Society, Keramic Studio, Kimball's Farmer, Ladies' Home Journal, Library Journal, Literary Digest, Ladies' World, Machinery, McClure's Magazine, Maxwell's Talisman, Modern Housekeeping, Modern Language Notes, Modern Priscilla, Municipal Journal and Engineer, New York Produce Review, North American Review, Orange Judd Farmer, Outing Magazine, Outlook, Pacific Monthly, Philosophical Magazine (British), Physical Review, Popular Mechanics, Popular Science Monthly, Pictorial Review, Pallette and Bench, Power, Psyche, Putnam's Monthly, Railway and Locomotive Engineering, Records of the Past, Reader, Reliable Poultry Journal, Review of Reviews, Saturday Evening Post, School Science and Mathematics, Scientific American, Science Abstracts, Sections A and B., Scribner's Monthly, Sibley Journal of Engineering, Speaker, Success, Table Talk, Technical World, Ueber Land und Meer, What to Eat, Wallace's Farmer, Woman's Home Companion, Woodcraft, World's Work, Youth's Companion, Zietschrift fur Analytische Chemie, Zoologische Anzeiger, Zoological Centralblatt.

Newspapers—The following state papers are on file in the reading room and are for the most part donated: Anaconda Standard, Basin Progress, Belt Valley Times, Big Timber Pioneer, Bozeman Chronicle, Butte Evening News, Chouteau Acantha, Carbon County News, Dillon Tribune, Fergus County Argus, Forsyth Times, Great Falls Leader, Inland Empire, Inter Lake, Judith Gap Journal, Kendall Miner, Madisonian, Meagher Republican, Missoula Daily Herald, Montana Daily Record, Montana Homestead, Montana Lookout, Montana Sunlight, Northwestern Stockman and Farmer, Phillipsburg Mail, Red Lodge Picket, Republican-Courier, Rocky Mountain Husbandman, Townsend Star, Tri-County News, Virginia City Times, Western News, Yellowstone Monitor.

DEPARTMENT OF ATHLETICS AND PHYSICAL CULTURE

MR. McINTOSH.

The gymnasium is described on page 11 of this catalogue. This furnishes adequate room for basketball practice and games, for baseball and football practice in bad weather and for gymnasium practice of various kinds during the winter months. A small amount of apparatus is available. The college furnishes the necessary equipment and materials for

basketball, football, baseball and track athletics.

The work of this department includes three main lines,—the coaching of athletic teams to represent the college in outside contests; the training of such men as present themselves during the winter for work in wrestling, boxing, and indoor work; and the general supervision of the physical welfare of all the students through a system of physical examination and prescribed exercises.

The college has been represented in inter-collegiate athletics during the past year by teams in basketball, track athletics, baseball, and football. All have done creditable work. Eligibility in these teams is determined under the rules of the Montana Inter-Collegiate Athletic Association.

The gymnasium work is open to all the young men of the college and the preparatory school and a good deal of interest has been aroused. Wrestling and boxing matches have been used to entertain the spectators between the halves of basketball games.

At the middle of each college year all the students of the college are requested to present themselves for a thorough physical examination; and on the showing thus made the instructor prescribes certain forms of exercise for each student, and makes simple recommendations regarding diet and hygiene. At each recurring annual examination the improvements are noted and further suggestion made.

Organization of Instruction

A. The following four year college courses, each leading to the degree of Bachelor of Science, are offered:

1.—Division of Agriculture.

1, Agronomy; 2, Animal Industry and Dairying; 3, Horticulture and Forestry.

2.—Division of Engineering.

1, Civil Engineering; 2, Electrical Engineering; 3, Mechanical Engineering.

3.—Division of Science.

1, Biology; 2, Chemistry; 3, Home Science; 4, History-Literature; 5, Mathematics-Physics; 6, Pharmacy.

B. The following courses, not leading to a degree are offered:

1.—Preparatory School.

2.—School of Agriculture.

3.—School of Pharmacy.

4.—Art School.

5.—Music School.

C.—The following special courses are offered:

1.—Household Economy.

2.—Agriculture.

3. Dairying.

Division of Agriculture

Four-year courses are maintained in (1)Agronomy, (2) Animal In dustry and Dairying, (3) Horticulture and Forestry. The aim is to give a scientific and practical training for the agriculturist, the stockman, the dairyman, the horticulturalist, and the forester. The work is the same for the first two years. At the beginning of the junior year the student chooses the group in which he desires to specialize. The completion of the new agricultural building, the purchase of additional lands, and the erection of farm buildings and barns, afford ample accommodation for the agricultural work. The equipment and other facilities are described in connection with the courses of study.

AGRICULTURE

FRESHMAN YEAR.

First Semester.		Second Semester	
French or German	4	French or German	4
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
General Botany (Biol. 9)	5	Plant Physiology and Histology (Biol. 10)	4
Trig. and Logarithms (Math. 2a)	3	Prin. of Horticulture (Hort. 1)	3
Farm Dairying (Dairy. 1)	3	Animal Types (An. Ind. 1)	3
Drill	1	Drill	1
	20		19

SOPHOMORE YEAR

English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Org. Chemistry (Chem. 5)	3	Agr. Chemistry (Chem. 7)	6
Qual. Analysis (Chem. 2)	4	Geology	2
Gen. Des. Physics (Phys. 1a)	3	Gen. Des. Physics (Phys. 1a)	3
Invert. Zoology (Biol. 1)	5	Vert. Zoology (Biol. 2)	4
		or Gen. Forestry (For. 2)	3
Crop Production (Agron. 1)	3	Field Crops (Agron. 2)	3
Drill	1	Drill	1
	21		20 or 21

Course in Agronomy

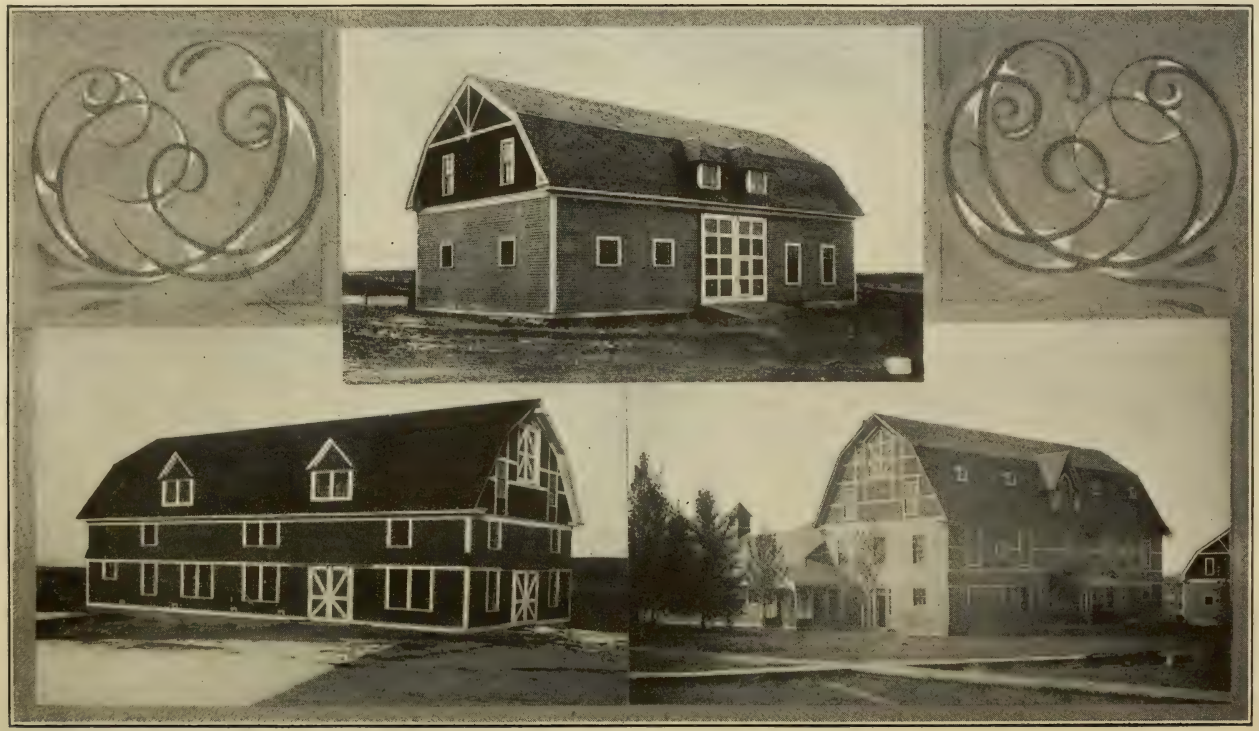
Agronomy is the science of the field and its crops. It treats of the production and improvement of field crops, the cultivation of soils and the maintenance of their fertility; and general farm management, which is the application of economic business methods to farm practices.

Because of the peculiar agricultural conditions existing in western states, a new agriculture is being developed. The handling of dry farming lands is necessary only in the West. The problems which have to do with irrigation water, and the cultivation of the soil and management of the crops under irrigation must be solved by western investigators and agriculturists. It is to fit men to deal with these and other questions of production on the farm that this course is offered.

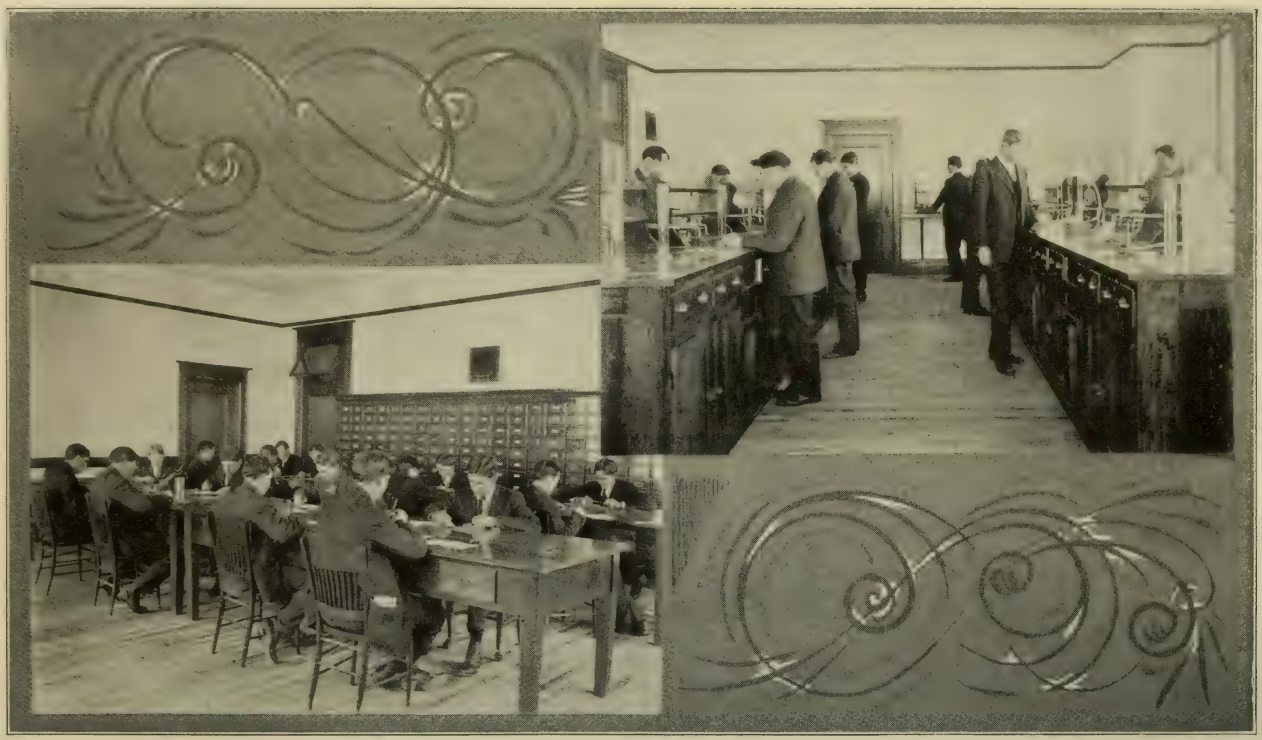
The first two years of the argonomy course are devoted to the study of the natural sciences, languages and some general agricultural work. This places the student in a position to appreciate and intelligently discuss the methods of practice taken up later in the course.

The last two years of the course are designed to give the student clear insight into methods for the cultivation and maintenance of the fertility of the soil; the peculiarities of the growth and handling of different crops; the arrangement, the laying out of the farm, and the principles which govern successful farm management.

With a constantly growing appreciation of the value of the agricultural lands of the west, comes an active demand for young men trained along the lines of practical and scientific agronomy, men who combine college training with practical experience and native ability. Such training is offered to young men in this course. The demand for such students is unlimited, at a compensation not exceeded in any other calling. A few of the many lines open to graduates of this department are: college and experiment station work, agricultural journalism, management of large irrigated and dry farms, management and salesmanships for seed firms, and superintendencies for companies with large land holdings.



FARM BUILDINGS.



GRAIN LABORATORY.

SOIL LABORATORY.

AGRONOMY

JUNIOR YEAR.

First Semester		Second Semester.	
Expository Composition (Eng. 2)	2	Expository Composition (Eng. 2)	2
Soil Physics (Agron. 3)	5	Soil Fertility (Agron. 4)	3
Plane Surveying (C. E. 1)	3	Agr. Mechanics (C. E. 7)	3
Field Practice (C. E. 1a)	2	Hist. of Agriculture (Agron. 5)	2
Stock Judging (An. Ind. 3)	2	Feeding Livestock (An. Ind. 4)	4
Bacteriology (Biol. 12)	5	Plant Pathology (Biol. 11)	4
Elective	3	Orgaic Evolution (Biol. 14)	2
	21		20

SENIOR YEAR.

Farm Management (Agron. 6)	3	Field Experimentation (Agron. 8)	3
Prin. of Breeding (Agron. 7)	4	General Entomology (Biol. 4)	4
Irrigation & Drainage (C. E. 10)	2	Farm Sanitation (Vet. Sci. 5)	3
Economics (Econ. 3)	2	Economics (Econ. 3)	2
Thesis (Agron. 9)	2	Thesis (Agron. 9)	2
Elective	6	Elective	5
	19		19

Course in Animal Industry and Dairying

The work in animal industry consists of study in judging, feeding, breeding, and caring for farm animals. The work in dairying consists of the handling, manufacture, and marketing of milk and its various products.

This course is designed to prepare young men for agricultural college and experiment station work, federal government work, farmers' institute work, positions as buyers and salesmen of livestock, teachers of animal industry and dairying in high schools, managers of large livestock and dairy farms, creamery and dairy inspectors, managers of dairy corporations and community milk depots, and above all, to furnish men with a scientific as well as a practical knowledge to operate their own farms in Montana.

The first two years of this course are given largely to a study of basic subjects, as English, modern language, mathematics, physics, chemistry and biology. The last two years the given to special practical and theoretical work in dairy manufactures, handling of milk, judging and feeding livestock, veterinary science, bacteriology and other allied subjects.

This course is given through text books, lectures, practice, and observation. Lectures are given by specialists and the student is made familiar with the most modern ideas and acquainted with the methods of the most successful breeders, feeders, and dairymen in this and European countries. The work in judging is given by the use of college animals and steriopticon lectures. To secure a variety of animals, excursions are made to stock farms near the college. Advantage is also taken of the live stock on exhibition at the state and local fairs. Practical instruction is also given in compounding rations, making out pedigrees and keeping breeding records.

The theoretical work in dairying is closely followed with practical work in handling separators, testing milk, ripening and churning cream and by all the actual work in the college creamery and cheese factory. The practical and theoretical are carefully combined.

ANIMAL INDUSTRY AND DAIRYING.

JUNIOR YEAR.

First Semester		Second Semester	
Expository Composition (Eng. 2)	2	Feeding Livestock (An. Ind. 4)	4
Breeds of Livestock (An. Ind. 2)	5	Poultry (An. Ind. 7)	3
Milk & Milk Testing (Dairy 2)	4	Anatomy (Vet. Sci. 1)	3
Dairy Manufactures (Dairy 3)	4	Farm Sanitation (Vet. Sci. 5)	3
Bacteriology (Biol. 12)	5	Animal Physiology and Anatomy (Biol. 3)	4
		Organic Evolution (Biol. 14)	2
	20		19

SENIOR YEAR.

Care and Management of Livestock (An. Ind. 6)	3	Care and Management of Livestock (An. Ind. 6)	3
Prin. of Breeding (Agron. 7)	4	Herd Books and Pedigrees (An. Ind. 5)	1
Stock Judging (An. Ind. 3)	2	Stock Judging (An. Ind. 3)	2
or Cheese Making (Dairy 5)	2	Obstetrics (Vet. Sci. 7)	3
Dairy Bacteriology (Dairy 4)	4	Animal Nutrition (Chem. 11)	3
Thesis (Dairy 6) or (An. Ind. 8)	2	Thesis (Dairy 6) or (An. Ind. 8)	2
Elective	4 or 5	Elective	4 or 5
	19 or 20		18 or 19

ELECTIVES.

Economics (Econ. 3)	2	Economics (Econ. 3)	2
Embryology (Biol. 13)	4	Pathology (Vet. Sci. 3)	3
Stock Judging (An. Ind. 3)	2	Common Diseases (Vet. Sci. 6)	2
Cheese Making (Dairy 5)	2	Toxicology (Vet. Sci. 8)	1
Materia Medica (Vet. Sci. 4)	3		

Horticulture and Forestry

The four years' course in horticulture, leading to the degree of Bachelor of Science in horticulture, is designed to prepare students as teachers in agricultural colleges, investigators in the agricultural experiment stations, editors of horticultural papers, managers of fruit associations, and superintendents of commercial orchards and fruit plantations. The western United States leads the world in methods of orcharding and disposing of orchard products, and there is a strong and growing demand for persons properly trained to manage the orchard projects now operated throughout the fruit regions of the West. Fruit growing, when done in a scientific way, is extremely profitable and presents an inviting field for the trained horticulturist. The college offers good facilities for a thorough training in all branches of horticulture.

The four years' course in forestry, leading to the degree of Bachelor of Science in forestry, offers instruction in the art and science of forestry and provides facilities for the education of students who desire to enter the United States Forest Service or to those who intend to become managers of large forest areas, or teachers of forestry in colleges and universities. The very extensive area of the western states now within National Forests and the still larger area of timber lands owned by individuals and companies will require the services of a large number of men who are trained along the lines of scientific forestry. The college is situated within a few miles of the Gallatin National Forest, where forest conditions can be studied at first hand. Within this National Forest are several saw mills, and an extensive area is being lumbered under the direction of the United States Forest Service. Excellent facilities for studying the methods of conservative lumbering are thus offered to students of forestry.

The courses in technical forestry will be given in co-operation with the U. S. Forest Service. A scientific forester employed upon the Gallatin National Forest, with headquarters at Bozeman, will give the lectures and conduct investigation work in technical forestry subjects. This arrangement offers the very best facilities for forestry students, as they are brought in direct contact with the men who are doing the forestry work in this country.

HORTICULTURE AND FORESTRY.

JUNIOR YEAR.

First Semester		Second Semester	
Soil Physics (Agron. 3)	5	Soil Fertility (Agron. 4)	3
Bacteriology (Biol. 12)	5	Plant Pathology (Biol. 4)	4
Plane Surveying (C. E. 1)	3	General Entomology (Biol. 4)	4
Field Practice (C. E. 1a)	2	**Vegetable Gardening (Hort. 3)	3
**Pomology (Hort. 2)	3	**Small Fruit Culture (Hort. 8)	3
**Expository Composition (Eng. 2)	2	**Expository Comp. (Eng. 2)	2
*Forest Botany (Biol. 15)	3	*Organic Evolution (Biol. 14)	2
*Silviculture (For. 3)	3	*Forest Protection (For. 4)	3
		*Forest Laws (For. 6)	2
	19 or 20		18 or 19

SENIOR YEAR.

Economics (Econ. 3)	2	Economics (Econ. 3)	2
Elementary Drawing (C. E. 29)	3	**Landscape Horticulture (Hort. 6)	3
**Prin. of Breeding (Agron. 7)	4	**Evolution of Cultivated Plants (Hort. 4)	3
**Commercial Fruit Growing (Hort. 7)	2	**Greenhouse Construction and Management (Hort. 5)	3
**Irrigation and Drainage (C. E. 10)	2	*Forest Economics (For. 9)	4
*Forest Measurement (For. 7)	3	*Forest Measurement (For. 7)	3
*Lumbering (For. 8)	4	*Lumbering (For. 8)	3
		*Forest Technology (Biol. 16)	3
Thesis	2	Thesis	2
Elective	4or 5	Elective	2 or 6
	19		19

*Required in the forestry course only.

**Required in the horticultural course only.

Unstarred subjects required in both courses.

Agronomy

PROFESSOR ATKINSON.

On the main floor of Agricultural Hall are the soil and grain laboratories and class rooms modern and thoroughly equipped.

The soil laboratory accommodating forty-eight students, provides for accurate work in soil physics and soil fertility. Upwards of two thousand dollars have been expended in equipping these laboratories with the most up-to-date fittings and apparatus, in order that the students may enjoy the very best facilities.

In the grain laboratory specially designed individual judging tables have been installed. This permits each student to pursue careful and continuous work in grain judging and enables him to become thoroughly familiar with the various grain standards. Vermin proof storage cases for class materials and standard samples have been provided. These insure the preservation of valuable material as accumulated. Score cards based on Montana conditions, have been prepared for wheat, oats, barley and corn, and are used to impress students with the points to be looked for in grain judging work.

A portion of the space in the greenhouses is given over to pot culture and germination work. Plots on the college farm are available for student work.

(1) **Crop Production.**—Reproduction, germination and growth. Vitality and germination of seeds with circumstances influencing these; conditions of plant growth, peculiarities of the different agricultural plants in respect to structure, habits and requirements for successful growth. I, 3.

(2) **Field Crops.**—A study of the grain crops, forage crops, root crops, sugar and fiber crops; their history and distribution, consumption of products and residues or by-products. In this course considerable time is spent in score card practice in the grain judging laboratory. II, 3.

(3) **Soil Physics.**—This course is designed to prepare the students to understand better the effects of the different methods of treating soils, and the influence of these upon moisture, texture, aeration, fertility, and production. It comprises a review of the origin, formation and classification of soils and a study of the conditions influencing the supply of heat, air and moisture as related to growing plants. The work of the class room is supplemented by laboratory work comprising the determination of such questions as the water holding capacity and capillary power of various soils, and the effect of mulches and of various systems of rotation on the physical condition of the soil. Lectures 2; laboratory 3; I, 5.

(4) **Soil Fertility**—Maintenance of fertility, fertilizers and rotation. The influence of barn yard manure, green manuring and commercial fertilizers upon the quality and yield of the various crops. The effects of

different crops upon the fertility of the coil and upon succeeding crops, different rotations and the ultimate effect of different methods of farm management upon the fertility and productive capacity of the soil, and also a study of the preservation of barn yard manure. II, 3.

(5) **History of Agriculture**—A study of the development of agriculture from the dawn of civilization, considering farming as carried on by the Greeks and Romans, through the middle ages, feudal farming, and the dawn of modern methods and practices in agriculture. II, 2.

(6) **Farm Management**—This course considers the problems of farm management. The relative profitis of different systems of farm management, the relation of the industry of agriculture to other industries, and the social conditions of agriculture are considered. I, 3.

(7) **Principles of Breeding.**—This course considers the different theories of plant and animal improvement, and embraces a study of selection, heredity, variation, atavism and fecundity; also cross breeding and in-and-in breeding, with a historical study of their results. I. 4.

(8) **Field Experimentation.**—This course comprises a study of the methods of presenting the results of field experiments; also a study of the plans and methods used in crop experimentation, with methods for keeping records. II, 3.

(9) **Thesis.**—Agronomy students are required to prepare a graduating thesis on some subject to be approved by the head of the agronomy department. The subject of this thesis must be decided upon not later than November 15th, of the senior year, and the thesis must include considerable research and experimental work on the part of the student. I and II, 4.

Animal Industry

PROFESSOR CLARK.

MR. SCHOPPE.

For the work in animal industry there is available a herd of thirty five dairy cows, small herds of pure bred cattle, Herefords, Shorthorns, Angus, Holsteins, Ayrshires, and Jerseys, Percheron horses, some pure bred Berkshire, Poland China, and Yorkshire swine, and Shropshire, Rambouillet, and Cotswold sheep. During the winter season the live stock used in the feeding experiments is also available for study. For the poultry work eight breeds of fowls are kept.

The cattle barn is a two-story frame building with two wings extending to the south. One of these wings is used for the dairy cows and breeding stock, and the other for bulls, young stock and calves. Between these two rooms is located a stock judging pavilion forty feet square. The

second story of the main barn is used for the storage of hay. The first story provides feeding rooms, storage for grain, and box stalls.

The new horse barn is a two story frame building with stalls for 20 horses, carriage and feed rooms, and capacity of 100 tons of hay.

The piggery consists of a main building thirty by thirty-five feet, with two wings sixteen by fifty feet each. In the main building are the feeding rooms and slaughter room, while the wings provide six pens each.

The poultry buildings include two main buildings, one seventy-two by sixteen feet, with twelve pens; the other one hundred and twenty-eight feet long with eight pens; with yards one hundred feet long on either side, and a brooder house, thirty-six by sixteen feet. These buildings are connected by a feed room, fourteen by twenty feet, under which is an incubator cellar and a heating plant for the building.

The Eleventh Legislative Assembly appropriated $10,000 to build sheep and steer feeding barns and to enlarge the poultry plant.

(1) **Animal Types.**—A study of types as related to production and work. This course covers the judging of the different market classes of cattle, (beef and dairy), of sheep, (mutton and wool), of horses, (light and heavy), and of hogs, (bacon and fat). The entire time of this course is given to practical handling and judging of the stock in the stock pavilion. Laboratory 3; II, 3.

(2) **Breeds of Live Stock.**—A study of the development of the breeds of horses, cattle, swine, and sheep will illustrate the principles and particular characteristics, and distinguish one breed from another, and will show the adaptability of each particular breed to various climates, conditions, and purposes. These lectures will be illustrated by stereopticon views of characteristic animals of the different breeds. Lectures, 4; laboratory, 1. I, 5.

(3) **Stock Judging.**—Animal measurements and the systematic study of animal form, function, and performance; the aim being to give exact and intimate acquaintance with the detailed form of specialized types, a knowledge that is essential to the highest success in selection and breeding; also some systematic work in the judging of groups of cattle, horses, sheep and swine, similar to those found at county and state fairs. Lecture, 1; laboratory 1. I and II, 4.

(4) **Feeding Live Stock.**—The principles underlying the profitable feeding of animals. The composition of plants, animals and animal products. The practice that gives best results as indicated by available data gathered from the work of experiment stations in this and other countries. II, 4.

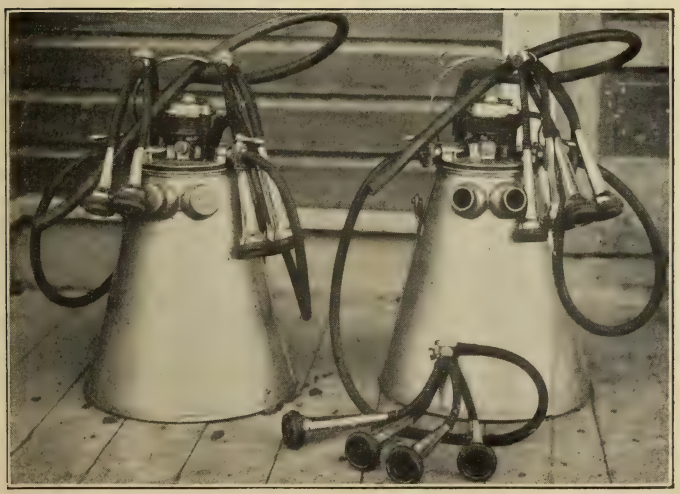
(5) **Herd Books and Pedigrees.**—This is largely a laboratory study of the herd books of different breeds of live stock. The tabulation of pedigrees and such other exercises as will enable the student to learn

the value of a pedigree and show how to keep the record of a breeding herd. II, 1.

(6) **Care and Management of Live Stock.**—A special study of the methods to be followed in the breeding, feeding and development of the various classes of live stock as illustrated from the practices of the most successful live stock breeders. I and II, 6.

(7) **Poultry.**—Breeds and management; poultry houses; feeding and care of poultry; the operation of incubators and brooders. II, 3.

(8) **Thesis.**—Students specializing in animal industry will be required to prepare a thesis during their senior year based upon some line of original work, to be arranged with the head of the department. I, and II, 4.



Milking Machine.

Dairying

PROFESSOR ELLIOTT.

The dairy is equipped with all modern appliances for the manufacture of butter and cheese. Eight hand separators afford the students an opportunity to compare the merits and demerits of the different types.

In churns there are the Perfection, Disbrow and Simplex. These are all combined churns and butter workers, yet are entirely different in style. In addition, the butter room is equipped with all modern appliances for handling milk and cream such as cream vats, tempering vats, Wizard and Jensen ripeners, starter cans, and Bohn refrigerator, together with all things necessary for the manufacture of butter in an up-to-date plant.

The creamery is equipped with a twelve horse power boiler and a ten horse power high speed engine, and in the practical work each student takes his turn in handling the engine and boiler for the experience gained thereby.

The cheese room is 30 by 30 feet with curing rooms 20 by 20 feet; in the former there are cheese vats, gang and upright presses and all necessary hoops and equipment for the manufacture of all varieties of American Cheddar cheese. In this department there is made both Edam and Brick cheese, but especial emphasis is placed on the manufacture of the American cheese.

The testing laboratory is very thoroughly equipped with four different styles of Babcock testers (both hand and steam) and all necessary glassware for the testing of milk, cream, butter, cheese, skim milk, whey, etc. Especial emphasis is laid upon the testing of milk and its products for adulterations.

In addition seven different tests for the determination of moisture in butter have been added as well as a complete equipment for acidimetry.

(1) **Farm Dairying.**—This course comprises a study of the subject of dairying and its general relation to the farm. The class work takes up production of milk, separation of cream by gravity and separator; the preparation of starters; the ripening and churning of cream; the packing and marketing of butter. The use of the Babcock tester is also discussed with particular reference to its use on the farm; also the contsruction of the milk house and stables with regard to sanitary conditions as well as to utility. Lectures, 2; laboratory, 1. I, 3.

(2) **Milk and Milk Testing.**—This course comprises a study of milk, its secretion, composition, and uses; pasteurization; separation and handling for city milk trade; the care of milk for creamery or cheese factory; the testing of variations and adulterations; the testing of butter and cheese; and the use of the acidimeter. Text books used: "Milk and Milk Testing," by Farrington & Wall; "Modern Methods of Testing Milk and

its Products," by VanSlyke; and "Dairy Laboratory Guide," by Melick. Lectures, 2; laboratory, 2. I, 4.

(3) **Dairy Manufactures.**—This course comprises advanced work in butter making, the scoring of butter and cheese, factory management and accounting, milk inspection, and the preparation of ice cream and ices.

This course is also intended to give the student a general knowledge of the different ways in which milk and its products are utilized outside of the scope ordinarily considered under dairying; such subjects as the preparation of condensed, certified, modified and hygienic milk. It also includes the study of the food value of milk and its products, in comparison with other common foods, preparation and utilization of milk sugar and casein. Text books used: "The Principles and Practice of Butter Making," by McKay and Larsen; and "Jensen's Milk Hygiene," by Pearson. Lectures, 3; laboratory, 1. I, 4.

(4) **Dairy Bacteriology.**—This course comprises a study of the relation of bacterial life to milk and milk products. The question of bacterial contamination of milk and methods of prevention; fermentations in milk and their treatment; disease producing bacteria in milk; preservation of milk with especial reference to pasteurization; and the bacteria in the food products,—milk, butter and cheese. Text books: "Practical Dairy Bacteriology," by Conn; and "Dairy Bacteriology," by Russel. Lectures, 3; laboratory, 1. I, 4.

(5) **Cheese Making.**—The equipment for factory and home cheese making, the principles and practice necessary to make a uniform article and methods used to overcome characteristic difficulties are explained and illustrated in the class room and laboratory. All common varieties of cheese, such as Cheddar, Swiss, Brick, and Limburger, are discussed, and as far as possible made in the cheese room, but the Cheddar cheese making is particularly emphasized. Test books: "Cheese-making," by Decker; and "The Science and Practice of Cheese Making," by Van Slyke & Publow. 1, 2.

(6) **Thesis.**—During the senior year all dairy students are required to prepare a thesis. This must be original work by the student, who should consult with the professor in charge regarding subject. Two credits will be allowed in the first semester and two in the second for this work. If it is sufficiently meritorious, such thesis may be published. I and II, 4.

Horticulture

PROFESSOR FISHER.

(1) **Principles of Horticulture.**—This course will deal with the principles underlying the various horticultural operations; variation, selection and crossing of plants with reference to plant improvement. The methods of pruning, cultivation, gathering and marketing of fruits and vegetables are studies along with the principles in each case. II, 3.

(2) **Pomology.**—This course deals with the principles and methods of fruit growing. The methods of propagating fruit trees and shrubs, pruning, cultivating and the general management of fruit plantations are considered. A systematic study of all northwestern fruits is made. I, 3.

(3) **Principles of Vegetable Gardening.**—Lectures and practice; treating of the principles and methods of growing vegetables under glass and in the field, particular attention being given to the vegetables suited to Montana conditions. II, 3.

(4) **Evolution of Cultivated Plants.**—Lectures and text book work on evolution relating to the cultivated horticultural plants. II, 3.

(5) **Green House Construction and Management.**—The construction, heating and maintaining of greenhouses, with lectures and practice treating of the methods of growing plants in greenhouses and conservatories. II, 3.

(6) **Landscape Horticulture.**—The laying out and planting of private and public grounds are discussed. The trees, shrubs and flowers suited to Montana conditions are studied. II, 3.

(7) **Commercial Fruit Growing.**—In this course the methods of planting, cultivating, irrigating and managing commercial orchards are discussed in the class room and orchard. The methods of picking, grading, packing and marketing fruits are important phases of the course. Lecture, 1; laboratory, 1. I, 2.

(8) **Small Fruit Culture.**—A study of the methods and principles underlying the culture of bush fruits; their classification and origin. Lecture, 1; laboratory, 2. II, 3.

(9) **Thesis**—Two credits throughout the senior year will be given for a thesis based upon original research along some horticultural line. I and II, 4.

Forestry

PROF FISHER.

(1) **Forestry Policy.**—Lectures and text book work pertaining to the policy of the United States government in regard to public forests; the growth and importance of the forest movement in the United States; the policy of the States in regard to State forests, etc. I, 3.

(2) **General Forestry.**—Treating of forest influences on climate, flow of streams, winds, etc. This course is required of all agricultural sophomores in the forestry course. II, 3.

(3) **Silviculture.**—The principles underlying the growth of trees in groups, or in the forest, methods of reproduction, discussion of the different silvicultural systems of management, and the application of each to a given tract and under various forest conditions. I, 3.

(4) **Forest Protection.**—A discussion and study of the methods employed in protecting forests against damage from fire, grazing, careless lumbering, etc. II, 3.

(6) **Forest Laws.**—The laws governing the federal forest reserves, the rules and regulations adopted by the forest service, and the several state laws governing state forests. II, 2.

(7) **Forest Measurement.**—This subject deals with the determination of the contents of logs, the construction of log rules, methods of scaling logs, estimating and cruising timber, the determination of yield, etc. Lectures, textbooks and extensive field practice. I and II, 6.

(8) **Lumbering.**—A history of the growth and importance of the lumber industry in the United States, the methods of lumbering in different sections of the country, the uses of the various kinds of trees, the methods and machinery employed in saw mills in manufacturing saw logs into lumber, and methods of lumbering as applied to different parts of the country and with different woods, in order to protect young growth and induce reproduction. This study will require the students to make a working plan of a given tract which is to be lumbered. In order to make the plan the tract will have to be cruised, the different kinds and grades of lumber estimated, the methods to be employed in cutting and logging to save young growth must be determined, logging roads to the mill must be laid out and constructed, the management and location of logging camps must be planned, etc. This course will be given by lectures, text books, required reading and very extensive field work in the forests near Bozeman. I and II, 7.

(9) **Forest Economics.**—This course deals with the position which the community and government should take with reference to their forest resources, the business aspects and conduct of forest lands, the relation of the lumber industry to the welfare of the nation, etc. II, 4.

(10 **Thesis.**—Four credits in the senior year are given for work upon a theseis based upon original study in forestry. I and II, 4.

Veterinary Science

The building formerly used for dairy will be repaired and fitted for veterinary science. By the opening of the college year, September, 1909, adequate equipment will be installed and a veterinarian placed in charge of this department.

(1) **Anatomy.**—Lectures describing the locomotory apparatus, including bones, articulation, and muscles; also careful description of the viscera, blood vessels, nerves and organs of special sense. The horse will be taken as a type. Laboratory dissection. II, 3.

(2) **Comparative Anatomy and Physiology.**—A more advanced and thorough consideration of the anatomical construction with special reference to the comparative anatomy and physiology of the horse, ox, sheep and hog. Laboratory dissection. I, 3.

(3) **Pathology.**—General pathology, consisting of a brief course in morbid anatomy and histology. Laboratory clinic. II, 3.

(4) **Materia Medica.**—This work will include a consideration of the common remedies used in the treatment of diseases. A few lectures will be given on toxicology and serum therapeutics. Laboratory tuberculin testing, mallein testing, vaccination and immunization. I, 3.

(5) **Farm Sanitation.**—A comprehensive course in general sanitation relating to sources of water, milk and food supplies, sewage disposal, source and spread of infectious diseases both of man and animals; the prevention and inhibition of infection, decomposition and decay. A study of asepsis, antiseptics, disinfection and disinfectants. II, 3.

(6) **Common Diseases of Farm Animals.**—Etiology, prophylaxis, diagnosis, treatment and eradication. This course will also include a few lectures on government control and supervision of diseases of livestock. II, 2.

(7) **Obstetrics.**—Diseases of animals incident to reproduction. The nursing and care of animals during this period, proper shelter with suggestions as to home treatment. II, 3.

(8) **Toxicology.**—This course includes a study of some of the more common poisons, their symptoms and antidotes. Post mortem examinations are made. II, 1.

Division of Engineering

The purpose of the courses offered in the division of engineering is to furnish the student the fundamental training essential to a successful engineer. This result is accomplished, not alone by the study of the theoretical, but by giving attention to the practical application of the principles involved. A limited degree of flexibility is given in some of the courses through electives, thus enabling the student to specialize in any chosen study.

Candidates for engineering courses must be graduates from accredited high schools, or the college preparatory department, or pass equivalent examinations.

Courses are offered in civil engineering, electrical engineering and mechanical engineering leading respectively to the degrees of Bachelor of Science in civil, electrical or mechanical, engineering. On the completion of one year of post graduate work, or three years of professional work and the presentation of an acceptable thesis, the college will confer upon the holders of bachelors' degrees in these courses the degrees rspectively of Civil Engineer, Electrical Engineer, or Mechanical Engineer.

Civil Engineering

This course is designed to give the student all of the fundamental studies necessary for the profession and at the same time especially qualify him to best meet the particular classes of engineering work most likely to be required in Montana.

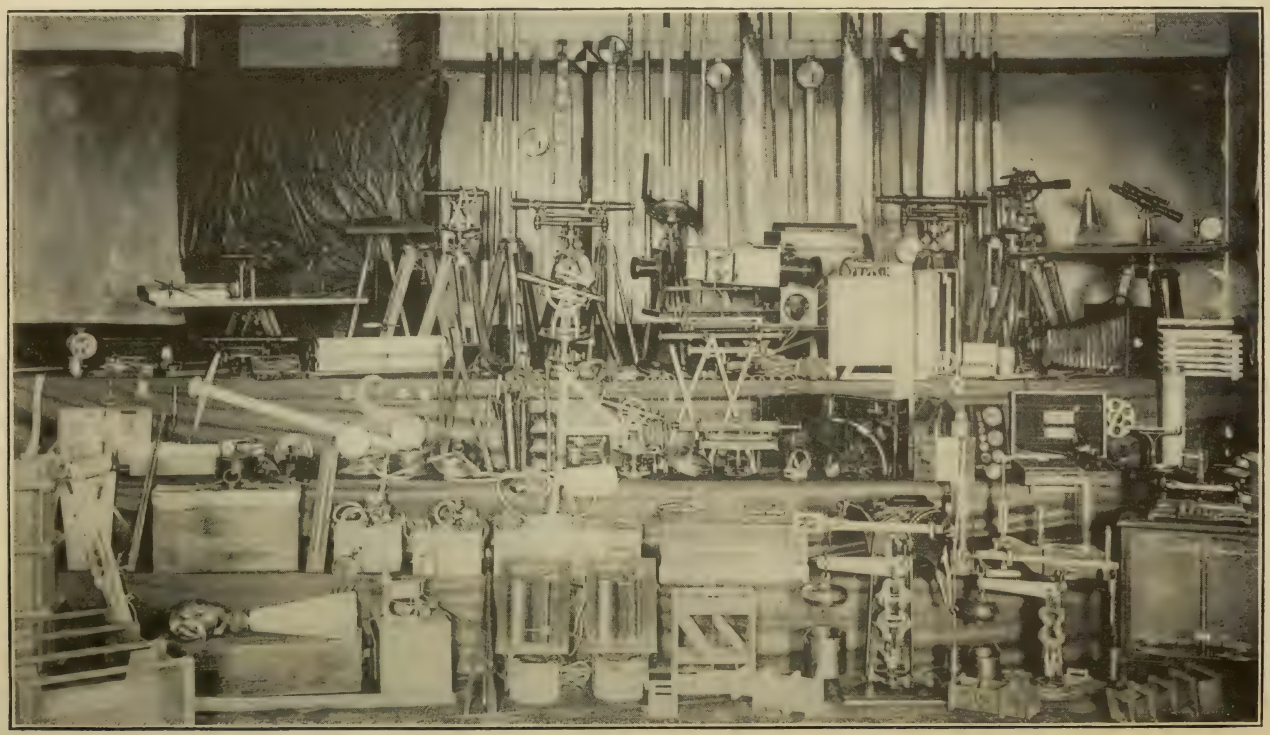
Without overlooking the importance of a thorough knowledge of the fundamental principles of engineering, the course has been designed to overcome partially some of the difficulties encountered by the young engineer in entering the work of practical life. We hope to meet in a small way the lack of understanding of practical rules and methods, for which so many of our college graduates are criticized by the general public and which so handicaps the student upon graduation. Not only is the student taught with the idea of making him an efficient office assistant, but a little insight is given into the practical; he makes estimates of cost of construction and such items as will enable him to appreciate the value and necessity of business and engineering methods, and possibly lead the way to engineering management and contracting.

Special care has been given to perfect the student, as far as possible, in the branches of engineering work which promise the best in the future of this state; namely, road and railway engineering; sanitary engineering; irrigation engineering; hydraulics and water power development.

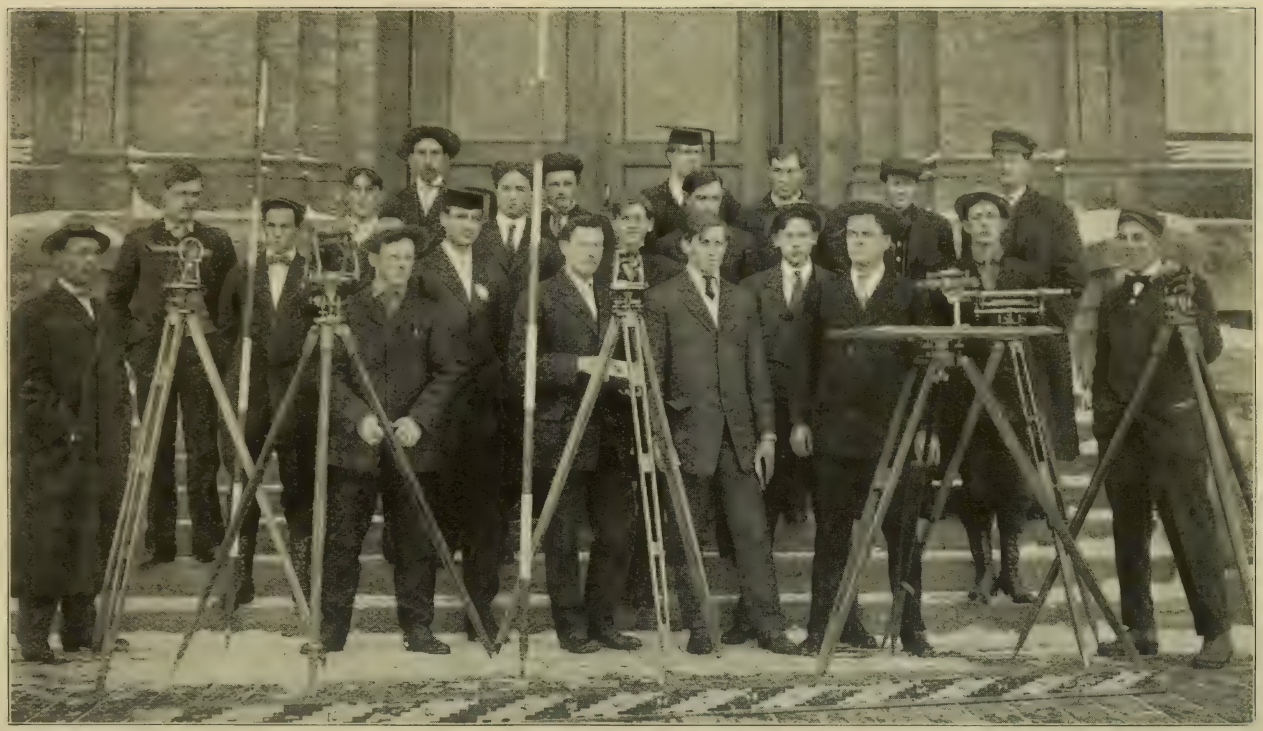
In order to enable the student to specialize, and to avoid the use of electives, the course has been divided, after the sophomore year, into two branches, both of which lead to the degree of B. S. in civil engineering. One course enables the student to become especially proficient in irrigation engineering and the use of instruments; while the other specializes in those studies essential to the sanitary engineer. Both courses are equally strong in railway and structural work.

As far as possible, the student taking this course will be expected to engage in practical engineering work during the summer vacations, and to this end each student registering in the course will be assisted in securing such positions as he may be able to fill at the close of each year. Thus far the demand for such student assistance has exceeded the supply.

The equipment of the department is up-to-date and sufficiently large to meet all present requirements.



CIVIL ENGINEERING.



CIVIL ENGINEERS.

CIVIL ENGINEERING

FRESHMAN YEAR.

First Semester		Second Semester	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Algebra, (Math. 1)	3	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Descriptive Geometry (M. E. 3)	2
Public Speaking (1)	1	Public Speaking (1)	1
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
Elementary Drawing (C. E. 29)	3	Mechanical Drawing (M. E. 3a)	3
Freehand Drawing (Art 3)	2	Freehand Drawing (Art 3)	2
Military Drill	1	Military Drill	1
	18		19

SOPHOMORE YEAR

Expository Composition (Eng. 2)	2	Calculus (Math. 4)	5
Calculus (Math. 4)	5	Electrical Machinery (E. E. 1)	1
General Physics (Physics 1)	3	Cement Tests (C. E. 15)	1
Physical Measurements (Phys.2)	2	General Physics (Physics 1)	3
Plane Surveying (C. E. 1)	3	Physical Measurements (Physics 2)	2
Field Practice (C. E. 1a)	2	Railway Engineering (C. E. 4)	4
Roads and Pavements (C. E. 2)	1	Field Work and Plotting (C.E 4a)	2
Military Drill	1	Military Drill	1
	19		19

JUNIOR YEAR

Theoretical Mechanics (C. E. 5)	4	Applied Mechanics (C. E. 6)	4
Hydraulics (C. E. 8)	3	Strength of Materials (M. E. 14)	1
Graphic Statics (C. E. 30)	2	Roofs and Bridges (C. E. 13)	2
Seminar (C. E. 12)	1	Engineering Design (C. E. 13a)	4
*Irrigation Engineering (C. E. 9)	2	Sanitary Eng. (C. E. 14)	2
*Field Practice (C. E. 11)	3	Reservoirs and Dams (C. E. 16)	1
*Least Squares (Math. 5)	2	Seminar (C. E. 12)	1
*Cost of Construction (C. E. 25)	2	*Light and Sound (Physics 3)	2
**Biology (Biology 9)	5	*Geology (Geol. 1)	2
**Qualitative Analysis (Chem. 2)	4	**Quantitative Analysis (Chem. 3)	4
	19		19

SENIOR YEAR

*Geodetric Surveying (C. E. 17)	2	Eng. Photography (C. E. 31)	1
Economics (Econ. 3)	2	Economics (Econ. 3)	2
Water Power Development (C.E. 18)	3	Contracts and Specifications (C. E. 23)	3
Engineering Design (C. E. 19)	3	Municipal Engineering (C. E. 3)	2
Seminar (C. E. 12)	1	Engineering Design (C. E. 19)	3
Foundations and Masonry (C. E. 21)	3	Seminar (C. E. 12)	1
*Field Practice (C. E. 20)	2	*Practical Astronomy (C. E. 24)	2
*Astronomy (Math. 6)	3	**Water and Air Analysis (Chem. 10)	2
**Bacteriology (Biol. 12)	5	Thesis (C. E. 27)	5
**Organic Chemistry (Chem. 5)	3		
	19 or 20		18

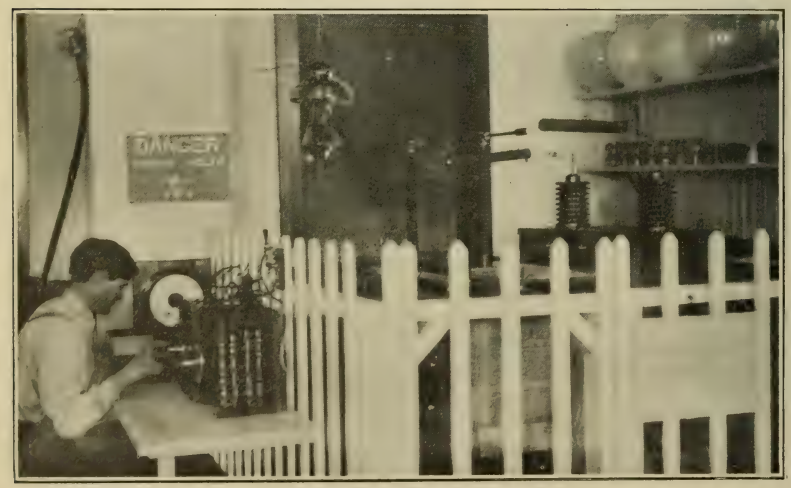
*Required in the regular course only.
**Required in the sanitary engineering course only.
Unstarred subjects required in both courses.

Electrical Engineering

This course provides a thorough technical training in electrical engineering. The rapid development of electrical engineering is largely due to the use of sound theory in the solution of commercial problems. For this reason the theoretical subjects, and the application of theory to the solution of practical problems are emphasized.

The course is designed to teach students the scientific laws and principles forming the basis of the profession, and the application of these laws and principles to commercial problems. The general training consists of courses in mathematics, physics, chemistry, drawing and shop work. The electro-technical work consists of lectures and recitations on the theory of electrical phenomena, and of problems in the design, construction and operation of electrical machines and apparatus. Conventional methods are used in drawing and designing, and the experimental tests made in the laboratory are essentially similar to the tests made by large manufacturing companies. The apparatus and instruments used are of modern commercial types.

The course is supplemented by an annual inspection trip to some of the large power plants of Montana, and by lectures by prominent electrical engineers.



150,000 Volt Transformer.

ELECTRICAL ENGINEERING.

FRESHMAN YEAR.

First Semester		Second Semester	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Algebra (Math. 1)	3	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Descriptive Geometry (M. E. 3)	2
Public Speaking (1)	1	Public Speaking (1)	1
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
Elementary Drawing (E. E. 21)	3	Mechanical Drawing (M. E. 3a)	3
Joinery (M. E. 2)	2	Forge (M. E. 6)	3
Foundry (M. E. 4)	1	Military Drill	1
Military Drill	1		
	19		20

SOPHOMORE YEAR

Expository Composition (Eng. 2)	2	Calculus (Math. 4)	5
Calculus (Math. 4)	5	General Physics (Phy. 1)	3
General Physics (Phys. 1)	3	Physical Measurements (Phys. 2)	2
Physical Measurements (Phys. 2)	2	Electrical Machinery (E. E. 1)	2
Forge Work (M. E. 9)	2	Dynamo Drawing (E. E. 2)	2
Military Drill	1	Military Drill	1
Elective	3 to 5	Elective	2 to 4
	18 to 20		17 to 19

JUNIOR YEAR

Theoretical Mechanics (C. E. 5)	4	Applied Mechanics (C. E. 6)	4
Applied Electricity (E. E. 3)	3	Dynamos and Motors (E. E. 5)	4
Electricity and Mag. (Phys. 5)	2	Dynamo Design (E. E. 8)	3
Electrical Measurements (Phys. 6)	2	Strength of Materials (M. E. 14)	1
Electrical Diagrams (E. E. 7)	2	Dynamo Testing (E. E. 6)	2
Electrical Lab. (E. E. 4)	2	Seminar (E. E. 17)	1
Seminar (E. E. 17)	1	Elective	2 to 4
Elective	2 or 3		
	18 or 19		17 to 19

SENIOR YEAR

Economics (Econ. 3)	2	Economics (Econ. 3)	2
Alternating Currents (E E. 9)	4	Alternating Currents (E.E. 11)	4
Transformer Design (E. E. 13)	3	Alternator Design (E. E. 16)	3
Power Plant Operation (E. E. 15)	1	Contracts and Specifications (E. E. 14)	1
Single Phase Testing (E. E. 10)	3	Polyphase Testing (E. E. 12)	2
Seminar (E. E. 17)	1	Seminar (E. E. 17)	1
Thesis (E. E. 20)	2	Thesis (E. E. 20)	3
Elective	2 or 3	Elective	2 or 3
	18 or 19		18 or 19

Mechanical Egineering

The purpose of this course is to prepare young men as fully as possible, within the limited time, for the management of manufacturing establishments, the designing, construction and erection of machinery, the superintendence of construction, and for other branches of the profession.

The course comprises four years' instruction and training by text book, lecture, laboratory and shop practice, based on the fundamental subjects, mathematics, physics, chemistry, pure and applied mechanics, machine design, structural design and thermodynamics. It is designed to give the student a thorough knowledge of the basic principles of his profession and such technical skill as the application of theoretical principles in every-day practice in shop and laboratory will insure, and so to strengthen his abilities that his future career may be the most successful of which he is capable.

It is a fundamental principle, recognized by educators that laboratory and shop work constitute a most important means of illustrating and impressing engineering principles, and with this in view the work of each department,—class room, laboratory, shop and designing room,—is made to supplement the work of each of the others, thus giving a balance in the mental equipment of the young engineer obtainable in no other way. The value of such balance to the engineer at the beginning of his career is recognized in the course offered on the opposite page.

MECHANICAL ENGINEERING

FRESHMAN YEAR.

First Semester		Second Semester	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Algebra (Math. 1)	3	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Descriptive Geometry (M. E. 3)	2
Public Speaking (1)	1	Public Speaking (1)	1
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
Mechanical Drawing (M. E. 1)	3	Mechanical Drawing (M. E. 3a)	3
Joinery (M. E. 2)	2	Forge Work (M. E. 6)	3
Foundry (M. E. 4)	1	Military Drill	1
Military Drill	1		
	19		20

SOPHOMORE YEAR

Calculus (Math. 4)	5	Calculus (Math. 4)	5
Expository Composition (Eng. 2)	2	Steam Engines and Boilers (M. E. 7)	3
General Physics (Phys. 1)	3	General Physics (Phys. 1)	3
Physical Meas. (Phys. 2)	2	Physical Meas. (Phys. 2)	2
Kinematics (M. E. 5)	2	Kinematics (M. E. 8)	2
Mechanical Drawing (M. E. 5a)	3	Mechanical Drawing (M. E. 8a)	1
Forge Work (M. E. 9)	2	Boiler Room Practice (M. E. 16)	1
Military Drill	1	Machine Work (M. E. 12)	1
		Pattern Work (M. E. 4a)	1
		Military Drill	1
	20		20

JUNIOR YEAR

Theoretical Mechanics (C. E. 5)	4	Applied Mechanics (C. E. 6)	4
Elect. and Magnetism (Phys. 5)	2	Machine Design (M. E. 13)	3
Elect. Measurements (Phys. 6)	2	Strength of Materials (M. E. 14)	1
Indicators and Valve Gears (M. E. 15)	2	Dynamos and Motors (E. E. 5)	4
Mechanical Laboratory (M. E. 15a)	1	Dynamo Testing (E. E. 6)	2
Hydraulics (C. E. 8)	3	Mechanical Drawing (M. E. 13a)	3
Graphic Statics (C. E. 30)	2	Machine Work (M. E. 21)	2
Mechanical Drawing (M. E. 10)	1	Seminar (M. E. 11)	1
Machine Work (M. E. 17)	2		
	19		20

SENIOR YEAR

Economics (Econ. 3)	2	Economics (Econ. 3)	2
Thermodynamics (M. E. 18)	4	Thermodynamics (M. E 22)	3
Boiler Design (M. E. 19)	1	Engine Design (M. E. 23)	2
Mechanical Drawing (M. E. 19a)	2	Mechanical Drawing (M.E. 23a)	2
Mechanical Laboratory (M.E. 20)	3	Roofs and Bridges (C. E. 15)	2
Tool Making (M. E. 27)	2	Engineering Design (C. E. 13a)	4
Seminar (M. E. 11)	1	Contracts and Specifications (M. E. 24)	1
Thesis (M. E. 26)	2	Shop Management (M. E. 25)	1
Elective	2	Thesis (M. E. 26)	2
		Elective	2
	19		21

CIVIL ENGINEERING.

PROF. TANNATT.
ASST. PROF. KNEALE.
MR. SNOW.

The equipment of this department consists of 4 transits, 2 with solar attachments; precision level; four engineers' levels; 3 plane tables with alidades and declinators; one sextant; artificial horizon; one reflectoscope; two engineers' aneroid barometers; one engineers' compass; clinometer; one hand level; one stadia hand level; one Burton's transit; five current meters; three automatic water registers; one Fairbanks' briquette testing machine with briquette molds, etc.; two vicat needles; one fineness scale; one set assay balances; one odometer; one specific gravity apparatus; one weir measuring device; one adjustable weir; one set of railway curves; one rolling planimeter; 2 polar planimeters; level and stadia rods; chains, tapes and pins; calculating instruments, etc.

In addition to the above the department is supplied with a good office equipment in the way of draughting instruments, scales, T squares, straight edges, etc.

A very complete cement testing laboratory has been added to the department during the past year, and students are enabled to specially qualify along this line of engineering.

The quarters of the department are in the second story of the main building and consist of two recitation rooms, one large draughting room, and the office. The draughting room is well supplied with desks and draught-boards, also a traveling blue print frame capable of printing drawings 36x52 inches. A suitable dark room and apparatus for teaching photography and the methods of making and printing blue-process papers forms a part of the equipment.

(1) **Plane Surveying.**—The use and adjustment of ordinary surveying instruments, such as the compass, level, transit, plane table, and sextant. The theory and practice of land surveying, leveling and topography; keeping of field notes and plotting. Text, "The Principles and Practice of Surveying" by Breed & Hosmer. Prerequisites, mathematics up to and including trigonometry. Lectures, 3. I.

(1a) **Field Practice.**—The practical use of ordinary civil engineering instruments in field work. Practice in measurement of lines and angles with the chain, tape, stadia, and transit. Measurement of fields, volumes, angles, and the calculations derived from same. The use of the level in measuring elevations, establishing grades, measurement of volume, etc. During inclement weather the student will be required to do plotting and make calculations from field notes. This course forms a part of the course in plane surveying. Text, Pence & Ketchum Surveying Manual. Laboratory, 2, II.

(2) **Roads and Pavements.**—A course in good road construction. Different methods of construction considered together with the best forms of surface, cost, etc. The influence of good roads upon property values and justifiable expense necessary to secure them. Illustrated lecture course. Elective to all regular students of the college or preparatory courses. Lecture, 1, I.

(3)—**Municipal Engineering.**—This course is designed especially to qualify the engineer along the lines of highway construction, both city and county. Different surface materials, influence of grades, forms of gutters, culverts, curbing, etc., are carefully studied. This course is especially designed to meet the requirements of the municipal engineer. Prerequisites, C. E. 1, 2 and 4. Text, Baker's Roads and Pavements Lectures, 2. II.

(4) **Railroad Engineering.**—Railroad reconnoitering, preliminary and location surveys. Theory and practice in laying out railroad curves, turnout, switches, and crossings. Cost of railroad construction, timber, structures and culverts. Making and use of profiles, field maps, cross sections, etc. Calculation of yardage in embarkments and excavation. Prerequisites, C. E. 1 and 1a. Text, Webb's Railroad Construction and Searle's Field Surveying. Lectures, 4. II.

(4a) **Field Work and Plotting.**—Practice in railroad topography, laying out curves and tangents, cross-sections, etc. A preliminary and location survey will be made and the students required to complete all maps, profiles and estimates for same. This course forms a part of C. E. 4, No text required, but the student will be required to provide himself with necessary drawing instruments. Laboratory, 2. II.

(5) **Theoretical Mechanics.**—Kinematics, Newton's laws of motion, dynamics of a particle, statics, friction, work and energy, dynamics of rotation, graphical and analytical methods employed. Text, Wright's Elements of Mechanics. Prerequisites, mathematics, including calculus, physics 1 and 2. Lectures, 4. I.

(6) **Applpied Mechanics.**—Resistance and elasticity of materials, shear, tension, compression, working stresses, design of riveted joints in pipes and cylinders, stresses in simple and cantilever beams, investigation and design of columns, torsion in shafting for transmitting power, resilience of materials. Text, Merriman's Mechanics of Materials. Prerequisites, C. E. 5 Physics 1 and 2. Lectures, 4. II.

(7) **Agricultural Mechanics.**—This course is especially designed to meet the requirements of the agricultural students and will include a study of farm structures, machines, etc., from the standpoint of mechanics. The course will also include a study of the design and operation of the gasoline engine. Lectures, 3. II.

(8) **Hydraulics.**—Theoretical hydraulics; hydraulic measurements; flow of water through orifices, over weirs, through pipes, conduits, and

canals. Text, Merriman's Hydraulics. Prerequisites, mathematics to and including calculus, physics 1 and 2. Lectures, 3. I.

(9) **Irrigation Engineering.**—This includes the impounding, diverting, and conveying of water; flumes, ditches, methods of measuring the duty of water and its relation to climate, soils, etc. Drainage of swamp and alkali lands. Text, Wilson's Irrigation Engineer. Prerequisites, C. E. 1 and 1a, 4 and 4a. Hydraulics must be taken in conjunction with this course. Lectures, 2. I.

(10) **Drainage and Irrigation.**—Theory and practice of irrigation. The principles underlying the application of water to growing crops. Duty of water and its relation to climate, soils, etc. Prevention of alkali and the reclamation of swamp and alkali lands. Text, King's Irrigation and Drainage. Prerequisites, C. E. 1 and 1a. Lectures, 2, I.

(11) **Field Practice.**—Practice in the use of engineering instruments in the field. This work is designed especially to develop speed and accuracy and to give practice in the more difficult problems of engineering. Advanced draughting during inclement weather. Regular in civil engineering course. Laboratory, 3. I.

(12) **Seminar.**—In this course the student is assigned some engineering topic, and is required to deliver a lecture upon same; after the lecture the meeting is thrown open for general discussion. Each week a student is selected, by the professor in attendance, to preside at the meeting. The object of the course is to familiarize the student with recent engineering works, to assist in English composition and public speaking, and to point out the essential features of engineering articles. By means of the reflectoscope, which forms a part of the department's equipment, the student is enabled to give illustrated lectures. Lectures, 1. I and II, 4.

(13) **Roofs and Bridges.**—Theory and calculation of stresses in roof and bridge trusses. Analytical and graphical methods employed. C. E. 13a, being a part of this course. Prerequisites, C. E. 5 and 6. Text, Merriman and Jacoby's text book on Roofs and Bridges. Lectures, 2. II.

(13a) **Engineering Design.**—The draughting and design of bridges, roof trusses, etc. This is part of the course in roofs and bridges and must be taken in conjunction with the same. Laboratory, 4. II.

(14) **Sanitary Engineering.**—Collection, purification and distribution of water; systems of water supply and sewerage; disposal of sewerage; house drainage; sanitary inspection. Text, Folwell's Sewerage. Prerequisites, C. E. 4, 4a, 5, 6, 8, 9, and M. E. 24. Lectures, 2 II.

(15) **Cement Tests.**—Study of physical properties of cement Testing the various natural and hydraulic cements under varying conditions and mixtures. Text, Taylor's Cement Testing. Lectures, ½; laboratory, 1. II, 1.

(16) **Reservoirs and Dams.**—This course is designed to supplement

the course in irrigation engineering. Study of the best methods of impounding water. Design and construction of earth, rock-fill and timber dams. Regular junior study C. E. course. Lectures, 1. II.

(17) **Geodetic Surveying.**—Elements of geodesy. Base line measurements, triangulation, determination of true meridian and latitude. Regular senior study of C. E. course. Text Breed &Hosmer's, Higher Surveying. Lectures, 2. I.

(18) **Water Power Development.**—A course in the development of water power. The design and use of the turbine, impulse and other forms of water motors. The design and construction of headraces, spillways, etc. The class will be required, whenever possible, to examine water powers, and report upon their design and method of development. Considerable time will be devoted to the description of recently installed plants as published in the engineering journals. Text, Merriman's Hydraulics, Reference, Church's Hydraulic Motors. Prerequisites, C. E. 1, 1a, 5, 6, 8, and M. E. 24. Lectures, 3. I.

(19) **Engineering Design.**—This course is devoted to the design of engineering works, maps, etc. Regular study in C. E. course. Laboratory, 3. II.

(20) **Field Practice.**—This course is designed to give practice in the most advanced surveying. Where the nature of the thesis is such as to require advanced surveying, or laboratory investigation, this period may, at the discretion of the class officer, be used to assist in preparation of the thesis. Laboratory, 2. I.

(21) **Foundations and Masonry.**—This course includes a study of materials and methods employed in the construction of piers, abutments, masonry dams, and retaining walls; economy of construction, strength of joined materials; composition of different kinds of mortar; reinforced concrete construction. Text, Baker's Foundations and Masonry. Regular in C. E. course. Lectures, 3. I.

(23) **Contracts and Specifications.**—The elementary law of contracts and its application to engineering considered, together with the correct form of specifications and the judicial interpretation placed on the technical terms commonly used in engineering specifications. Text, Johnson's Contracts and Specifications. Elective to all engineering students after the sophomore year. Lectures, 3. II.

(24) **Practical Astronomy.**—A short course in astronomy designed especially for the civil engineering students and to supplement the artronomy of mathematics. A considerable portion of the time in this course will be given in the form of evening work in taking observations on the circum-polar stars, and a part of the time to solar observations. Text, Comstock's Field Astronomy for Beginners. Prerequisites, mathematics, 6. Laboratory, 2. II.

(25) **Cost of Construction.**—This course is designed to acquaint the

student with the cost of labor and materials used in engineering construction; to point out the necessity and methods of keeping accurate records of the cost of proposed engineering surveys, and construction work. Text, Gillette's Cost Data. Prequisites, C. E. 1, 1a, 4, 5, 6, 8, 13 and 13a. Lectures, 2. II.

(27) **Thesis.**—The student will be required before graduation to present a suitable thesis upon some engineering subject in the line of his course. A copy of the same, together with all original maps, tables, etc., typewritten, bound, and upon specified paper, will be filed with the college and become its property. The student is required to select his subject at the beginning of the senior year. 5

(28) **Electives.**—Students will be permitted to take any electives for which they are qualified and for which they have the time. The selection will be subject to the approval of their class officer and the instructor teaching the subject.

(29) **Elementary Drawing.**—This course is designed to teach the students the use of draughting instruments; projection and isometric drawing; mapping and lettering. The course has been arranged to harmonize with Art 3, and is specially designed for civil engineering students or those students requiring a special knowledge of mapping and field sketching. Laboratory, 3. 1.

Owing to the demand for advanced work in topographical draughting, this course is extended through the second semester for all students desiring additional practice, and is elective to all completing the first semester of C. E. 29. The additional credits thus taken will not be used to substitute for other studies required in the course, but as extras.

(30) **Graphic Statics.**—This course is designed to lead up to the course in roofs and bridges, and to familiarize the student with graphical methods of making solutions to problems. C. E. 5 is a prerequisite to, or must be taken in conjunction with, this course. Text, Johnsons Graphics. Lectures, 2. I.

(31) **Engineering Photography.**—This course is designed especially for the civil engineering students, and is expected to teach the application of photography to engineering and surveying. The student is first taught how to expose and develop photographic plates, after which he is instructed in topographic sketching from photographs. Special attention is given to photographing maps and engineering objects. Text, Topographical Drawing and Sketching, by Lieut. H. A. Reed. Lectures, 1; laboratory, 1. II.

ELECTRICAL ENGINEERING.

PROF. THALER.

The electrical engineering department occupies a two story stone building, 36x52 feet. The first floor contains the dynamo laboratory, the machines for testing the strength of materials and two steam engines. The second floor contains a class and drafting room, an arc light room, a battery room, a photometer room, and an office. Steam and electrical power are obtained from the main power house.

The equipment of the electrical laboratory is very complete, with apparatus of modern type. There are two double current multipolar generators, capacity 15 K. W. These machines may be driven by the 40 H. P. engine or by the laboratory motor, and may be used as direct current dynamos, as alternators, simple, two or three phase, as synchronous motors or as rotary converters.

The two machines are also used for practice in synchronizing, and furnish alternating current for the induction motors, and for the mercury arc rectifier. For direct current work the laboratory contains in addition to the two generators, one Excelsior 15 light arc dynamo, connected to eight series-arc-lamps, arranged for testing purposes, one 15 H. P. Northern Electric Co. motor, one 10 H.P. Siemens and Halske motor and one 16 H. P. Western Electric Co. bipolar motor. Each motor is provided with a friction brake and other auxiliary apparatus for complete tests of the armature and field resistances, of the magnetic distribution and leakage, and of the efficiency and regulation at different loads; one a 6 K. W. Excelsior dynamo may be used as either a shunt or a compound machine, and is driven by the 10 H. P. motor and arranged for testing purposes.

For alternating current work the laboratory contains, in addition to the two generators, one mercury arc rectifier, capacity 30 amperes at 110 volts; one 2 H. P. single phase Westinghouse induction motor with phase splitter, provided with a prony friction brake for efficiency and regulation tests at different frequencies and at different voltages; one 6 H. P. three phase General Electric Co. induction motor, also provided with auxiliary apparatus for testing purposes.

There are six transformers, with capacities from 1 to 1½ K. W. and with different ratios. The transformers are arranged for testing the core losses, the copper losses, and the efficiency and regulation at various frequencies and voltages. They are also used for practice in transformer connecting for different purposes.

For general testing the laboratory contains one stationary lamp bank of 136 incandescent lamps with a current capacity of 130 amperes at 110 volts; the lamps are arranged so that the current can be regulated within a small fraction of one ampere; four portable lamp banks of ten

lamps each, arranged so that the lamps can be connected either in series or in parallel; one 900 Ohm iron wire resistance and five iron wire resistances for heavy currents, besides a number of rheostats, switches and circuit breakers.

The laboratory contains twenty-nine electrical measuring instruments, including nine voltmeters; one Whitney 150-300 volts; one Whitney 15 volts; one Weston 150 volts; one Weston milli-voltmeter; one Weston 75-150 volt A. C.; one Westinghouse 150 volts switchboard voltmeter.

We have eight portable ammeters: one 5 ampere D. C. Weston, three Whitney ammeter,s capacity 10, 25 and 50 amperes, D. C., respectively; two Hoyt's A. C. ammeters, 10 and 30 amperes respectively; one G. E. ammeter with series transformer, 120 amperes A. C.; and one Westinghouse ammeter, 120 amperes.

We have four portable wattmeters; one Westinghouse, with series transformer, capacity 100 amperes at 200 volts; one Hoyt, capacity 1500 K. W.; one Weston, with multiplier, 2 amperes at 2250 volts; one G. E. Co. wattmeter, capacity 10,000 watts.

There is one Leeds potentiometer with standard cell and standard resistances for calibrating instruments; one Kelvin standard balance for calibrating wattmeters; one Weston portable galvanometer; one Jacobi testing set for measuring resistances; and four intergrating wattmeters, besides several switchboard instruments.

The arc light room contains eight series-arc-lamps and five constant potential arc lamps of different types arranged for testing.

In the photometer room is a Willyoung station photometer with universal rotator and bunsen screen for testing the candle power, distribution of light, and the efficiency of incandescent lamps.

The battery room contains a storage battery of 56 cells at 60 ampere hours capacity, of the following types: 10 chloride accummulators, 10 National battery Co.'s unit accumulator, 10 Willard cells and 10 American cells. The batteries furnish current for calibrating instruments and are also available for testing purposes.

The office contains a 700 candle power Cooper-Hewitt mercury vapor lamp, a Nerst lamp, and the apparatus for calibrating instruments.

A 150,000 volt testing transformer for testing insulation resistances has been added to the laboratory equipment during the past year.

(1) **Electrical Machinery.**—Lectures on the construction, care and operation of commercial electrical machines and apparatus, including batteries, electric lights, dynamos, motors, alternators, transformers and electrical measuring instruments. Text book. Introduction to Electrical Engineering by H. H. Norris. Lectures, 2. II.

(2) **Dynamo Drawing.**—Detail working drawing, tracing, and blue printing of electrical machines in the laboratory, to familiarize the stu-

dent with the conventional methods of representing the different parts of dynamos and motors. Laboratory, 2. II.

(3) **Applied Electricity.**—Methods and calculations of wiring, theory of primary cells and storage batteries, electric light and electrical measuring instruments. Prerequisites, Calculus and Physics (1). Textbook, Elements of Electrical Engineering, by Franklin & Esty. Lectures, 3. I.

(4) **Electrical Laboratory.**—Tracing circuits and wiring, calibrating instruments, efficiency tests of storage batteries, and the candle power of incandescent lamps. Prerequisites, Physics (2). Textbook, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. I

(5) **Dynamos and Motors.**—Principles of electro-magnetism, theory of dynamo electric machines, the design, construction and regulation of direct current dynamos and motors. Prerequisites, Physics (1) and Calculus. Textbook, Elements of Electrical Engineering, by Franklin & Esty. Lectures, 4. II.

(6 **Dynamo Testing.**—Laboratory tests to determine armature and field resistance, magnetic leakage coefficients, characteristic curves and the efficiency and regulation of various types of direct current machines. Prerequisites, Physics (2)) and (6). Text book, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. II.

(7) **Electrical Diagrams.**—Conventional methods of representing electrical wiring and appliances. Drawings and wiring diagrams of the switchboards in the laboratory and in the power house and diagrams of the wiring of the college buildings. Laboratory, 4. I.

(8) **Dynamo Design.**—Problems in designing electro-magnets, dynamos and motors. Complete working drawings and specifications to accompany each design. Prerequisite, dynamo drawing. Reference, Design of Dynamos, by S. P. Thompson. Laboratory, 3. II.

(9) **Alternating Currents.**—Theory of alternating currents, properties of alternating current circuits, principles of alternators, tansformers, rotary converters and induction motors, methods of testing alternating current apparatus. Prerequisites, Physics (5). Text book, Alternating Currents, by Franklin & Esty. Lectures, 4, I.

(10) **Single Phase Testing.**—Laboratory tests of single phase alternating current generators, motors and transformers, calibration of alternating current measuring instruments and meters. Prerequisite, Physics (6). Text book, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 3. I.

(11) **Alternating Currents.**—Development of the symbolic method of Steinmetz, the solution of problems in transformer design and calculation of transmission line by the use of the algebra of complex numbers and by vector diagrams. Prerequisite, alternating currents (9). Text book, Alternating Current Phenomena, by Steinmetz. Lectures, 4. II.

(12) **Polyphase Testing.**—Laboratory tests of polyphase alternating current apparatus, including generators, motors, transformers and converters. Efficiency and regulation tests of a mercury arc rectifier, connection of transformers for transforming from three phase to two phase. Prerequisite, alternating current testing. Text book, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. II.

(13) **Transformer Design.**—Design and drawing of transformers to conform with certain specifications of efficiency and regulation. Calculation of the cost of the transformer. Open to students taking E. E. 9 and 11. Laboratory, 3. I.

(14) **Contracts and Specifications.**—The law of contracts and its application to engineering contracts. Students are required to make specifications for estimates on proposed power plants, transmission lines or electrical apparatus. Text book, Contracts and Specifications, by Johnson, and Electrical Lighting Specifications by Merrill. Lectures, 1. II.

(15) **Power Plant Operation.**—Practice in the operation and care of boilers, engines, dynamos, motors, electric lights and storage batteries of the college power plant. Laboratory, 1. I.

(16) **Alternator Design.**—Problems in designing alternators, converters and induction motors. Design and specifications of alternating current circuits. Prerequisites, alternating currents (9). Laboratory, 3. II.

(17) **Seminar.**—Weekly meeting for the purpose of discussing current electrical engineering literature. Lectures, 1. I and II, 4.

(18) **Special Design.**—Design and construction of some special electrical apparatus or machine. Elective for seniors. Laboratory, 3. I or II.

(19) **Inspection Trips.**—Annual excursions are made to one of the large power plants. Students are required to observe and make a report of the type and arrangement of the apparatus and of the methods of operation. Required of seniors in electrical engineering.

(20) **Thesis.**—Before graduating each student must present a suitable thesis upon some engineering subject in line with his course. One copy of the thesis will be filed in the college library as the property of the college. The subject for the thesis must be chosen at the beginning of the senior year. 5. I and II.

(21) **Elementary Drawing.**—Plain lettering, the use of instruments, geometrical problems, orthographic, isometric, and cabinet projections of simple objects. Laboratory, 3. I.

MECHANICAL ENGINEERING.

PROF. COUPER.
ASSSOCIATE PROF. DEARBORN.
MR. CARLSON.

In selecting and specifying the required work of the mechanical engineering course the idea has been to give the student a knowledge of and some practice in those subjects that are essential in his preparation for the various lines of work generally recognized as belonging to this profession. Where the work of the mechanical engineer overlaps that of the civil or electrical engineer subjects from those courses are included in the requirements of this course, thus giving the student as complete a preparation as could reasonably be demanded of him.

For the drawing in this course there is provided a large well lighted room in the basement of the main building. Forty-seven double desks and thirty lockers provide facilities for one hundred and twenty- four students. The college furnishes the drawing boards. The students furnish their own instruments, triangles, scales, etc. For instruction in drawing there are numerous models, parts of machinery, blue prints and drawings. The work in drawing is carried on in conjunction with class work in the study of machines, engines and boilers, and in the design of them. Working drawings comprise a considerable portion of the work and in this way the close relation of the drafting room to the shop is emphasized, as the work in the shops is carried on by the use of working drawings similar to those made in the drawing room. The work includes designing, which in addition to applying the principles of machine design developes a certain degree of originality in invention. The equipment of the drawing room includes a blue printing outfit, two beam compasses, a B & S. protractor, a Robinson Odontograph and a Universal drafting instrument.

In the laboratory work of this course the apparatus and experiments are selected to demonstrate as far as possible the class work in the study of engines and boilers and in designing of machinery.

For engine tests there are available an 8x12 high speed Woodbury engine and a vertical 7x7 Detroit engine, in the mechanical engineering laboratory; a 70 H. P. Lycoming engine in the college power plant and a compound Advance traction engine. The Woodbury engine is belted to two 15 K. W. generators, which are used to put a load on the engine. The engine has connections and reducing motion for steam engine indicators. A friction brake is fitted to one of the fly wheels, which is flanged to allow for a means of cooling it with a stream of water, thus making it possible to carry on tests of considerable duration. The steam piping is so arranged that the engine may be run condensing or noncondensing, with or without live or exhaust steam in the jackets. The exhaust is connected to a 50 H. P. Dean Bros. surface condenser. The condensed

steam is weighed in tanks placed on Howe scales of 1200 lbs. capacity. The water used for condensing the steam may be measured by a weir or by meters. The 7x7 vertical engine is also provided with the necessary connections and reducing motion for indicator work, and a friction brake for loading the engine. The engine may be connected with the condenser. The eccentric is adjustable on the shaft, and practice is given the student in setting the valve, which is of the piston type, by measurements as well as by using the steam engine indicator.

For steam engine indicator work there are two Crosby, one Thompson and a Tabor (outside spring) compound indicator. The Tabor indicator can be used for either steam or gas. The Crosby indicators have electro-magnetic attachments for taking cards simultaneously from each end of the cylinder. There are several reducing motions of the wheel, pantograph and pendulum types; also a planimeter for obtaining the area of indicator cards. The accuracy of indicator springs is tested by attaching the indicator to a drum in which the steam pressure can be regulated, by valves, from zero pressure to boiler pressure. The pressure is obtained by an accurate test gauge attached to the drum. With these instruments the student learns to determine the horse power developed by the engine, to judge whether the valves are properly set, and the method of setting valves correctly.

Boiler tests are made on the water tube and horizontal multi-tubular boilers of the power plant and on the traction engine already mentioned. For this work there are provided tanks, scales, thermometers, pyrometers, steam gauges, etc. A new Crosby steam guage testing outfit affords a means of calibrating all the gauges used in this work. Schaeffer and Budenburg throttling and separating calorimeters are used to determine the condition of the steam. A No. 6 Lunkenheimer injector is used in making tests of the capacity and efficiency of this class of apparatus.

An aluminum Corliss valve model about two feet long, having all the parts of a valve of this class, is used to show the action of the valves and the method of adjusting the valvegear. A plain slide valve model about four feet long, designed and built at the college, gives opportunity to study, under favorable conditions, all the variations to which a slide valve is subject. This model is very carefully constructed and graduated so that it may be used for checking slide valves designed to fulfill various conditions.

A Riehle testing machine of 100,000 lbs. capacity is used for testing the strength of materials used in engineering and to confirm formulas and values used in machine design and structural work. This machine is provided with all the necessary grips and blocks for making tension, compression and transverse tests of metals, woods, stones, bricks and cement. A magnetic friction clutch may be used to automatically adjust the balance. Mounted on the machine is an automatic attachment for

WOOD SHOP.



MACHINE SHOP.

obtaining the characteristic curves of materials subjected to the various stresses. In addition to these is an extensiometer with double micrometer screws reading to ten-thousandths of an inch and a deflectometer reading to thousandths of an inch.

Torsion tests are made on an Olsen torsion machine, capable of breaking a specimen one and one-quarter inches square. For measuring specimens there is a two inch micrometer caliper, a six inch Starrett beam micrometer and a twelve inch steel scale. Specimes to be tested are prepared in the shop, thus giving the students additional opportunity to become acquainted with the characteristics of the materials used in engineering and to appreciate more fully the objects and results of the tests. Samples of the specimens are analyzed by the chemical department and the results recorded with the tests.

The shops are equipped with standard machinery and tools for working wood and metal. This equipment is being added to as needed, both by purchase and by manufacture in the shops.

The forge shop is 28x36 feet and contains eleven down draft power forges with Sturtevant blowers, a 50-lb. power hammer, shear, and a full equipment of anvils and small tools. In the work here a graded series of exercises leads the student from simple drawing and upsetting to size, to complex forging and tool making, hardening and tempering, all the work being done from working drawings.

The brass foundry, 24x28 feet, is equipped with brass furnace, core oven, crucibles, flasks, patterns and small tools. The work comprises bench and floor molding, melting, pouring, etc., lectures pertaining to general foundry practice being given at the same time. The castings produced are used in the machine work.

The machine shop measures 60x72 feet, and adjoining it are the tool room, stock room, office, lavatory and locker room. The equipment includes an 18 inch Davis and Egan, a 16 inch LeBlond and three 16 inch Flather engine lathes, a 22 inch Flather planer, a 16 inch Davis and Egan shaper, a Gisholt tool grinder, a 28 inch Cincinnati drill, a 20 inch Prentice drill, a 14 inch sensitive drill, a 24 inch Barnes grinder, a 6 inch pipe machine, speed lathe, power hack saw, etc., and in the tool room a No. 1 Cincinnati universal milling machine, a Cincinnati universal grinder, a Yankee drill grinder, a brazing and tempering outfit, besides a complete equipment of small tools.

The wood shop measures 36x50 feet and is furnished with modern wood-working machinery, including a 20 inch Fay planer, a 14 inch circular pattern saw, a 36 inch band saw, a Fay universal jointer, a Fay and Egan friezer, a jig saw, foot mortiser, trimmer, a 16 inch pattern lathe, seven 10 inch lathes with turning-tools for thirty-six students, and seventy-two complete sets of carpenters tools, with benches for joinery, house carpentry, pattern wook and cabinet work.

(1) **Mechanical Drawing.**—The use of drawing instruments and plain lettering; problems in geometric construction to teach accuracy in the use of instruments; isometric and cabinet projections and simple perspective. Laboratory, 3. I.

(2) **Joinery.**—A graded set of problems is given with instruction in the proper use and care of carpenter's tools and practice in working to dimensions from blue prints. Laboratory, 2. I.

(3) **Descriptive Geometry.**—Projections of lines, plane surfaces and solids; intersections, tangents to curves and surfaces; problems in warped surfaces; practical applications. Text, Faunce. Lectures, 2. II.

(3a) **Mechanical Drawing.**—Problems in descriptive geometry; finding the position of points, lines and surfaces; intersection of solids, development of surfaces; making patterns for such objects as bath tubs, boiler sheets, and other sheet metal work. Laboratory, 3. II.

(4) **Foundry.**—The instruction includes practice in floor and bench molding, core making, and pouring, with lectures on general foundry practice in iron and brass. Laboratory, 1. I.

(4a) **Pattern Making.**—A short series of exercises in wood turning followed by practice in the construction of wood patterns for use in the foundry. Soph., II. I.

(5) **Kinematics.**—A study of the relative motions of machine parts, including belting, toothed gears, cams and linkages. The class room work is supplemented by a parallel course in drafting. Text, Schwamb & Merrill, Elements of Mechanisms. Lectures, 2. I.

(5a) **Mechanical Drawing.**—Applications of the principles of kinematics and drawing velocity diagrams, spur and bevel gears and cams. Laboratory, 3. I.

(6) **Forge Work.**—A graded set of exercises in iron forging, designed to teach the operations of drawing, upsetting, forming and welding, followed by exercises in forging, hardening and tempering tool steel, with lectures on the manufacture and properties of iron and steel. Laboratory, 3. II.

(7) **Steam Engines and Boilers.**—A study of the different types and their classification. A description of the various parts and their uses, together with a careful study of combustion and the properties of steam. The care and operation of engines and boilers as regards safety and economy. Text, Spangler, Green and Marshall, Hubbard. Lectures, 3. II.

(8) **Kinematics.**—A continuation of Kinematics (5) Lectures, 2. II.

(8a) **Mechanical Drawing.**—A continuation of mechanical drawing, (5a) Laboratory, 1. II.

(9) **Forge Work.**—A continuation of the work in steel forging, including tempering, annealing and case-hardening. Laboratory, 2. II.

(10) **Mechanical Drawing.**—A continuation of mechanical drawing (8a) in which the work will be detail drawings of machine parts preparatory to the work of machine design. Laboratory, 1. I.

(11) **Seminar.**—Weekly meetings held to discuss current engineering literature. Lectures, 1. I and II, 4.

(12) **Machine Work.**—Bench work, including chipping, filing, fitting, scraping, laying out work, soldering and brazing. Prerequisites, M. E. 4, 6 and 9. Laboratory, 1. II.

(13) **Machine Design.**—Class room work, in the study of machines in regard to size, form and strength. The developments and the application of mathematical formulas to the solution of problems in designing machinery. Prerequisites, M. E. 5 and 5a and C. E. 5. Text, Machine Design by Smith & Marx. Lectures, 3, II

(13a) **Mechanical Drawing.**—Application of the principles of machine design to size, form and strength of machines and machine parts. Laboratory, 3. II.

(14) **Strength of Materials, Laboratory.**—Each student is required to make a definite series of tests of wrought iron, cast iron, steel and wood in tension, compression, bending and torsion. Prerequisites. C. E. 5. Laboratory, 1. II.

(15) **Indicators and Valve Gear.**—A study of the slide valve, both in its simple form and in combination with independent cut-off valves, link motions and other reversing gears; automatic cut-off gears, the Zeuner diagram; principles and operation of the indicator. Prerequisites, M. E. 7. Text, Spangler's Valve Gears. Lectures, 2. I.

(15a) **Mechanical Laboratory.**—Setting of valves with and without the use of the steam engine indicator. Testing of indicator springs and determining the horse power of engines by using the indicator and brake. Each class designs and contructs a reducing motion for some engine or pump. Prerequisites, M. E. 7. M. E. 15 must be carried in conjunction with this subject. Laboratory, 1. I.

(16) **Boiler Room and Engine Practice.**—Each student spends 2½ hours per week as assistant in the college power plant, obtaining practical experience under a first-class engineer in handling boilers, pumps, engines, heating apparatus and electrical machinery, including dynamos, motors, and switch board. Laboratory, 1. II.

(17) **Machine Work.**—Instruction and practice in lathe work, drilling, boring, thread and gear-cuttin,g with lectures. Prerequisites, M. E. 12. Laboratory, 2. I.

(18) **Thermodynamics.**—A thorough course in theory, and its application, especially to the steam engine. Prerequisites, Phys. 1 and 2. M. E. 7, 15, 15a, and 16. Text, Peabody, Thermodynamics of the Steam Engine. Lectures, 4. I.

(19) **Boiler Design.**—A study of steam boilers with reference to set-

ting, capacity, strength and construction. Specifications of material to be used and method of handling. Prerequisite, M. E. 7, 13, 14, and 16. Text, H. De B. Parsons, Steam Boilers. Lectures, 1 I.

(19a) **Mechanical Drawing.**—A completion of the drawing in machine design and the making of drawings for a steam boiler. Prerequisite, M. E. 13 a. Laboratory, 2. I.

(20) **Mechanical Laboratory.**—Calibration of instruments and apparatus for testing, including indicator springs, steam gauges, meters, scales and reducing motions; testing of injectors, condensers, boilers, steam and gas engines, together with calorimetric determination of the condition of steam by means of both the separating and throttling calorimeters. Testing of flue gases and the determination of the calorific values of coals. Complete test of power plant. Prerequisite, M. E. 7, 15 and 15a. Laboratory, 3. I.

(21) **Machine Work.**—Advanced work on lathe, grinder and milling machine; tool making. Prerequisite, M. E. 17. Laboratory, 2. II.

(22) **Thermodynamics.**—A continuation of (18) in the application of the principles of thermodynamics to internal combustion engines, compressed air, refrigerating machines, injectors, condensers, and steam turbines. Lectures, 3. II.

(23) **Engine Design.**—The constructive details of some type of automatic cut-off engine, Corliss engine or steam turbine, will be worked out in the class room, and working drawings thereof made. Prerequisite, M. E. 7, 13, 14, 15, 15a, 16, 18. Text, Whitman, Steam Engine Design. Lectures, 2. II.

(23a) **Mechanical Drawing.**—Designing and drawing of plans for engines and steam applicances. Laboratory, 2. II.

(24) **Contracts and Specifications.**—The various forms of contracts and the value and necessity of legal contracts will be considered. The work in specifications will be to examine the common forms in use and write up complete specifications for some engineering project. Text, Johnson, Contracts and Specifications. Lectures, 1. II.

(25) **Shop Management.**—Lectures on the organization and arrangement of manufacturing plants; cost accounting, shop methods, duplication of work. Prerequisite, M. E. 27. Lecture, 1. II.

(26) **Thesis.**—Before graduation each student must present a suitable thesis, the result of original investigations. The subject must be chosen at the beginning of the senior year. 3. I and II.

(27) **Tool Making.**—The manufacture of reamers, drills, taps, mills and dies, and a study of the characteristics and heat treatment of high speed steel. Laboratory, 2. I.

Division of Science

The college offers six separate courses leading to the degree of bachelor of science, which are tabulated on the following pages. It will be noted that in these tabulations there is but little change in the actual requirements from the work offered during the past ten years. In the earlier years of the course, much of the foundation work in science, language and mathematics is common to all the courses.

The names given to these courses are generally indicative of their nature.—Biology, Chemistry, Home Science, History-Literature, Mathematics-Physics, and Pharmacy.

Candidates for the bachelor's degree in science must complete satisfactorialy not less than 130 credits, including the prescribed work in military drill or domestic science; and including also a thesis, the value of which in credits shall be determined by the instructor concerned. No regular student may take in any one semester work amounting to more than nineteen credits or less than twelve.

Students who are relieved for any reason of the requirements in military drill or domestic science, shall present four additional credits in some other subject; but the president may, at his discretion, excuse from such requirements any student in the employ of the institution.

Several subjects taught in departments not represented in this division are open to election by students in science on consent of their advisers. Among these may be mentioned music, (limited to four credits for any one person) and such subjects in the divisions of agriculture or engineering as the applicants may be qualified for, and as the schedule permits. In general the credits to be allowed for these are to be determined by the agreement of the instructors concerned.

A more detailed statement of the direct purpose of these courses may be found just preceding the tabulation of each course.

Biology

Through the electives allowed in the biology course the student may select lines leading toward the following professions: general zoology, general botany, economic entomology, plant pathology, and bacteriology. The course also furnishes an excellent preliminary training for the professions of medicine, veterinary science, forestry, and teaching. In the government service, both in the Department of Agriculture at Washington and in the various experiment stations, there are many desirable openings both for young men and young women. In plant pathology, bacteriology, and entomology there is a growing demand for suitably qualified workers. Women are more and more in demand as scientific clerks and assistants. The passage of the Adams act whereby the federal appropriation to the experiment stations in the various states is materially increased, is creating a greater demand for workers in biological as in other lines, and as never before the outlook in these lines is inviting.

The biology course is characterized by wide privileges in electing, but it is intended that the student shall be guided by his class officer in selecting the subcourses that contribute most directly to his chosen line of work.

For graduation from the course in biology, one year of Latin and a reading knowledge of French and German are required. More of each is desirable, but as soon as these amounts are accomplisehd, the student may elect other subjects in place of foreign language.



Biology Building.

BIOLOGY.

FRESHMAN YEAR.

First Semester		Second Semester	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Foreign Language	4	Foreign Language	4
Invertebrate Zoology (Biol. 1)	5	Vertebrate Zoology (Biol. 2)	4
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
Drawing from Nature (Art 4)	1	Drawing from Nature (Art 4)	3
Public Speaking	1	Drill	1
Drill	1		
	18		18

SOPHOMORE YEAR.

Expository Composition (Eng. 2)	2	Expository Composition (Eng. 2)	2
Foreign Language	4	Foreign Language	4
Algebra and Trigonometry (Math. 1 and 2)	5	Animal Physiology and Anatomy (Biol. 3)	4
General Botany (Biol. 9)	5	Plant Physiology and Histology (Biol. 10)	4
Organic Chemistry (Chem. 5)	3	Organic Chemistry (Chem. 5)	3
Drill	1	Drill	1
	20		18

JUNIOR YEAR.

English Literature (Eng. 10)	2	English Literature (Eng. 10)	2
Foreign Language	4	Foreign Language	4
Gen. Des. Physics (Phys. 1a)	3	Gen. Des. Physics (Phys. 1a)	3
Embryology (Biol. 13)	4	General Entomology (Biol. 4)	4
or Bacteriology (Biol. 12)	5	Geology (Geol. 1)	2
Elective	2—6	Elective	1—4
	16—19		16—19

SENIOR YEAR.

Advanced English Composition or Literature, (Eng. 3, 11, or 13)	2	Advanced English Composition or Literature (Eng. 3, 11, or 13)	2
Economics (Econ. 3)	2	Economics (Econ. 3)	2
Psychology (Psych. 1)	3	Ethics (Ethics 2)	3
Thesis	5	Thesis	5
Elective	4—7	Elective	4—7
	16—19		16—19

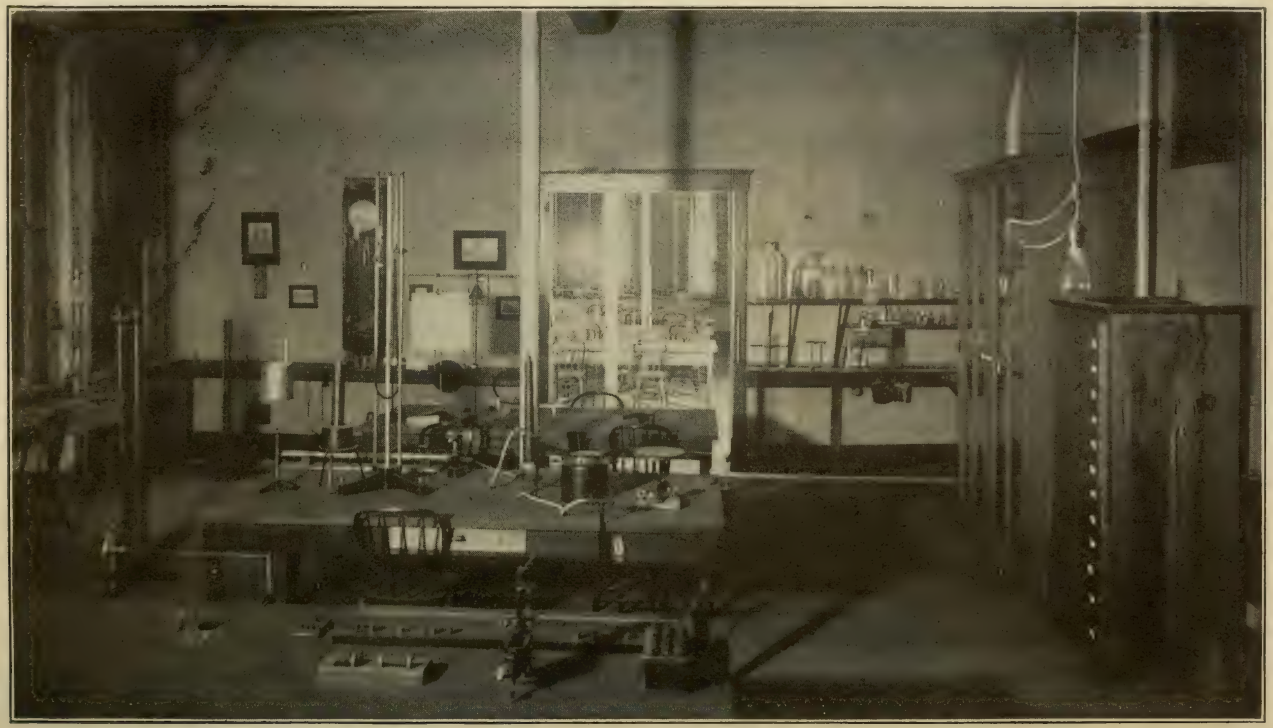
Chemistry

The principles of chemistry, together with some of the applications of the science, are taught to the freshmen in all courses offered by the college. In addition to this elementary instruction some departments require sufficient training in chemistry to enable the student to apply the principles of the science to some special phase of the general course he is pursuing. This is true in the college courses in agriculture, domestic sci- and sanitary engineering. Further, students who wish to follow chemistry as a profession are advised to take systematic training in the science during the four years of undergraduate study.

The outline of studies offered in the chemical course is designed to meet the needs of the last named class of students. It is believed such a course should provide a liberal education along with as much technical skill as it is possible to obtain. With this end in view and with the idea that the technical training should have some definite aim, two options are offered. One option gives a training in the various branches of chemistry together with several fundamental courses in biology and agriculture, the other option combines a number of carefully selected engineering studies with the chemistry.

The agricultural option gives an excellent foundation for the future study of almost any phase of agricultural science. Especially it leads to agricultural chemistry as applied in experiment station laboratories. The engineering option offers a combination of studies which approaches what is usually known as a course in chemical engineering. It prepares for positions in chemical laboratories connected with manufacturing industries and for conducting operations requiring a working knowledge of both chemistry and engineering.

In the following schedule of studies, those subjects marked with one star (*) are required only of those who elect the agricultural option. The studies required in the engineering option are marked with two stars (**), while the unstarred subjects are required of all students who take the chemical course. The freshman and sophomore years are the same for both options.



PHYSICS LABORATORY.



CHEMISTRY LABORATORY.

CHEMISTRY LECTURE ROOM.

CHEMISTRY.

FRESHMAN YEAR.

First Semester		Second Semester	
Algebra, (Math. 1)	3	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	General Chemistry (Chem. 1)	4
General Chemistry (Chem. 1)	4	English Composition (Eng. 1)	2
English Composition (Eng. 1)	2	German or French	4
German or French	4	Descriptive Geometry (M. E. 3)	2
Mechanical Drawing (M.E. 1)	3	Mechanical Drawing (M. E. 3a)	2
Drill	1	Drill	1
	19		19

SOPHOMORE YEAR.

Qualitative Analysis (Chem. 2)	4	Quantitative Analysis (Chem. 3)	4
Calculus (Math. 4)	5	Calculus (Math. 4)	5
General Physics (Phys. 1)	3	General Physics (Phys. 1)	3
Physical Meas. (Phys. 2)	2	Physical Meas. (Phys. 2)	2
German or French	4	German or French	4
Drill	1	Drill	1
	19		19

JUNIOR YEAR.

Organic Chemistry (Chem. 5)	3	Organic Chemistry (Chem. 5)	3
Quantitative Analysis (Chem. 3)	4	Proximate Organic Anal. (Chem. 4)	4
Expository Composition (Eng. 2)	2	Expository Composition (Eng. 2)	2
*Invertebrate Zoology (Biol. 1)	5	Geology	2
*Soil Physics (Agronomy 3)	5	Light and Sound (Physics 3)	2
**Electricity and Magnetism (Phys. 5)	2	Physical Meas. (Phys. 4)	1 or 2
**Electrical Meas. (Phys. 6)	2	*Animal Physiology (Biol. 3)	4
**Foundry (M. E. 4)	1	**Forge Work (M. E. 6)	3
**Kinematics (M. E. 5)	2	**Electrical Machinery (E. E. 1)	2
**Drawing (M. E. 5a)	3		
	19		19

SENIOR YEAR.

Economics	2	Economics	2
Industrial Chemistry (Chem. 9)	5	Physical Chemistry (Chem. 6)	4
Thesis (Chem. 15)	2	Thesis (Chem. 15)	2
*Mineralogy (Chem. 12)	1	*Plant Physiology (Biol. 10)	4
*Proximate Organic Anal. (Chem. 4)	4	*Soil Fertility (Agron. 4)	3
*General Botany (Biol. 9)	5	*Elective	4
**Mineralogy (Chem. 12)	3	**Steam Engineering (M. E. 7)	3
**Assaying (Chem. 13)	4	**Machine Work (M. E. 12)	1
**Applied Electricity (E. E.3)	3	**Dynamos and Motors (E. E. 5)	4
	19	**Dynamo Testing (E. E. 6)	2
			18 or 19

History and Literature.

In accordance with the general plan of the division of science, this course leads to the degree of bachelor of science. It includes properly, therefore, strong courses in at least two of three sciences, physics, chemistry and biology, though it does not contemplate advanced work in any of these subjects. Throughout the course a large amount of time is devoted to the study of foreign language and during the later years of the course a good deal of time is given to history and literature. It is not expected that the graduate in this course will be technically equipped in any of these subjects, though by the systematic arrangement of his electives he may emphasize such lines of the work as he is especially attracted to. Graduates should therefore be fitted to teach in the high schools, history, English, and one or more of the foreign languages. The prime purpose of the course, however, is to offer to those who can afford it a good general education, the purpose of which shall be a wide acquaintance and sympathy with the most important ideas and activities of civilization.

Such an education, it is believed, is well worth having for its own sake; and for those who can afford the time, it is a valuable preparation for the specialization of the graduate school, or of the professional or technical school.

HISTORY-LITERATURE.

FRESHMAN YEAR.

First Semester		Second Semester	
Algebra (Math. 1)	3	Anal. Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Foreign Language (Fr., Ger., or Latin)	4
Foreign Language (Fr., Ger., or Latin)	4	General Chemistry (Chem. 1)	4
*General Chemistry (Chem. 1)	4	or Vertebrate Zoology (Biol.2)	4
or Invertebrate Zoology (Biol. 1)	5	or Plant Phys. (Biol. 10)	4
or General Botany (Biol. 9)	5	English Composition (Eng. 1)	2
English Composition (Eng. 1)	2	Public Speaking (1)	1
Public Speaking (1)	1	Art	2
Military Drill	1	Military Drill	1
or Gen. Cookery (Home Sci. 1)	2		17
	18 or 19		

SOPHOMORE YEAR

Foreign Language	6 or 8	Foreign Language	6 or 8
English Composition (Eng. 2)	2	English Composition (Eng. 2)	2
European History (Hist. 1)	2	English Literature (Eng. 10)	2
English Literature (Eng. 10)	2	European History (Hist. 1)	2
*Gen. Descriptive Phys. (Phys.1a)	3	Gen. Descriptive Phys. (Phys. 1a)	3
or Biology (1 or 9)	5	Military Drill	1
or Chemistry (1)	4	or Sewing (Home Science 12)	2
Military Drill	1	Elective	0-3
or Sewing (Home Science 12)	2		16-19
Elective	0-3		
	16-19		

JUNIOR YEAR

Economics (3)	2	Economics (3)	2
Foreign Language	2-4	Foreign Language	2-4
English Literature or Composition (English 3, 11 or 13)		English Literature or Composition (English 3, 11, 12 or 13)	
or History (2 or 5)	2-3	or History (2 or 5)	2-4
Elective	9-12	Constitution of U. S. (Pol. Sci. 1)	2
		Elective	4-9
	16-19		15-19

SENIOR YEAR.

Psychology (1)	3	Ethics (2)	3
Sociology (Pol. Sci. 2)	3	Thesis (3)	6
Elective	9-13	Elective	7-10
At least 4 credits must be taken in either History, English or Foreign Language.		At least 4 credits must be taken in either History, English or Foreign Language.	

*All candidates for a degree in this course are required to take one year each in two of the three sciences: biology, chemistry, and physics.

**The order in which the required subjects are to be taken up in the junior and senior years may be varied upon the consent of the class officer and the instructor concerned.

Home Science.

The object of this course is two-fold: First, to give young women a liberal education with a scientific basis and to train them along lines pertaining to the science, management and care of the home. Second, to give training to those who wish to become teachers of home science. This course gives an opportunity for the combination of biology or chemistry with home science. Music, literature and art are elective studies.

Considerable latitude is allowed in electives. If sewing (11) and food principles (2) are not elected in the freshman year they must be taken in the sophomore year.



Home Science Reception Room.

HOME SCIENCE.

FRESHMAN YEAR.

First Semester		Second Semester	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
French, German or Latin	4	French, German or Latin	4
Plane Trig. and Logarithms (Math. 2a)	3	Public Speaking (1)	1
Algebra (Math. 1)	3	General Chemistry (Chem. 1)	4
Public Speaking (1)	1	Cooking (H. S. 1)	2
General Chemistry (Chem. 1)	4	Food Principles (H. S. 2)	2
Cooking (H. S. 1)	2	Elective	2
	18-19		17

SOPHOMORE YEAR.

French, German or Latin	4	French, German or Latin	4
European History (Hist. 1)	2	European History (Hist. 1)	2
Invertebrate Zoology (Biol. 1)	5	Animal Physiology and Anatomy (Biol. 3)	4
Economic Use of Food (H.S. 3)	2	House. Econ. Entomology (Biol. 7)	2
Garment Making (H. S. 12)	2	Economic Use of Food (H. S. 3)	2
Art	2	Garment Making (H. S. 12)	2
Elective	2	Art	1
	19	Elective	2
			19

JUNIOR YEAR.

English Composition (Eng. 2)	2	English Composition (Eng. 2)	2
Economics (Econ. 3)	2	Economics (Econ. 3)	2
Organic Chemistry (Chem. 5)	3	Food Chemistry (Chem. 8)	3
Bacteriology (Biol. 12)	5	Invalid Cookery (H. S. 5)	2
Dressmaking (H. S. 13)	2	Dressmaking (H. S. 13)	3
Architecture and Sanitation (H S. 4)	2	Journal Meetings (H. S. 7)	2
Elective	3	Elective	5
	19		19

SENIOR YEAR.

Language or History	2	Language or History	2
Psychology (Psych. 1)	3	Ethics (Ethics 2)	3
Final Demonstration (H. S. 6)	2	Final Demonstration (H. S. 6)	2
Journal Meetings (H. S. 7)	2	Journal Meetings (H. S. 7)	2
or Practice Teaching (H. S. 8)	2	or Practice Teaching (H. S. 8)	2
Thesis	4	Dressmaking (H. S. 13)	3
Elective	5	Thesis	4
		Elective	4
	18		19

Mathematics and Physics.

This course as outlined on the opposite page is designed to fill the needs of two or three classes of students. The required work is such as to give an excellent preparation for students desiring to become teachers in these subjects, and by proper choice of the electives a broad education in other subjects may be obtained. Prospective teachers are advised to arrange their electives so that they will be qualified to teach other subjects, such as biology, chemistry, English or foreign language, as often they are required to teach such subjects in combination with mathematics or physics.

There is an increasing demand for men who have a more extended and exact knowledge of these fundamental sciences than can be obtained from the ordinary technical course. This call comes from a class of employers who desire men so equipped and prefer to give them the practical training they need. This course is designed to give just such training. If the student should take this course, planning to take an engineering course later, he can choose his electives so that any of the engineering courses may be completed in two years after graduation from the Mathematics-Physics course. In this case the following subjects are suggested from which it is desirable to elect: Freehand drawing, mechanical drawing, chemistry, mechanics, applied electricity, dynamos and motors, hydraulics, sanitary engineering. The particular electives of this course will be chosen in accordance with the direct aim of the student. In addition, the above course lays a foundation for the work of the graduate school.

MATHEMATICS-PHYSICS.

FRESHMAN YEAR.

First Semester		Second Semester	
Algebra (Math. 1)	3	Anal. Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	English Composition (Eng. 1)	2
English Composition (Eng. 1)	2	Public Speaking (1)	1
Public Speaking (1)	1	German or French	4
German or French	4	General Chemistry (Chem. 1)	4
General Chemistry (Chem. 1)	4	Military Drill	1
Military Drill	1		
	17		16

SOPHOMORE YEAR.

Calculus (Math. 4)	5	Calculus (Math. 4)	5
General Physics (Phys. 1)	3	General Physics (Phys. 1)	3
Physical Measurements (Phys. 2)	2	Physical Measurements (Phys. 2)	2
German or French	3 or 4	German or French	3 or 4
Expository Composition (Eng. 2) or English Literature (Eng. 10)	2	Expository Composition (Eng. 2) or English Literature (Eng. 10)	2
Elective	0 to 4	Elective	0 to 4
Drill	1	Drill	1
	17-20		17-20

JUNIOR YEAR

Differential Equations (Math. 10)	3	Geology (Geol. 1)	2
Electricity and Magnetism (Phys. 5) and Electrical Meas. (Phys. 6) or Least Squares (Math. 5)	4 2	Differential Equations (Math. 10)	3
Economics (Econ. 3)	2	Light and Sound (Phys. 3)	2
Elective	6 to 10	Physical Measurements (Phys. 4)	2
		Economics (Econ. 3)	2
		Elective	6 to 8
	17-19		17-19

SENIOR YEAR.

Theoretical Astronomy (Math. 6)	3	Theoretical Astronomy (Math. 6)	3
Two Courses from Advanced Phys. (Phys 7) and Mathematics (11, 12, 13 or 14)	3 2 or 3	Two Courses from Advanced Phys. (Phys. 7) and Mathematics (11, 12, 13 or 14)	3 2 or 3
Elective and Thesis	7 to 11	Elective and Thesis	7 to 11
	17-19		17-19

Pharmacy.

The objects of this course in pharmacy are to furnish: (a) A thorough, scientific foundation for the pursuit of the profession. (b) A preparation for the study of medicine. (c) A basis for graduate work leading to the higher degrees. (d) A training for teachers of pharmacy and for food and drug inspection chemists, as well as other high positions of the profession.

The curriculum of the first and second years is devoted chiefly to the preparation of the student in the various foundation sciences, and that of the junior and senior to strictly pharmaceutical and cognate subjects, with electives and thesis, for the purpose of allowing the student to specialize for any desired position.

As a pursuit, pharmacy has at least three distinct branches, namely, dispensing practice, pharmaceutical manufacture and foreign trade. In each branch there is a large amount of work that can be done only by persons of proper scientific training. This training is best obtained by laboratory work and lecture studies in chemistry, general, analytical and organic and in pharmacy and cognate subjects.



Pharmacy Laboratory

PHARMACY.

FRESHMAN YEAR.

First Semester.		Second Semester.	
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
Trigonometry (Math. 2)	2	Analytical Geometry (Math. 3)	4
Algebra (Math. 1)	3	Plant Physiology and Histology (Biol. 10)	4
German	4	German	4
General Botany (Biol. 9)	5	Drill	1
Drill	1		
	19		17

SOPHOMORE YEAR.

Organic Chemistry (Chem. 5)	3	Organic Chemistry (Chem. 10)	3
Qualitative Analysis (Chem. 2)	4	Qualitative Analysis (Chem. 3)	4
German or French	3 or 4	German or French	3 or 4
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Introductory Pharmacy (1)	5	Official Pharmacy (2)	4
Drill	1	Pharmacy Laboratory (3)	2
		Drill	1
	18 or 19		19 or 20

JUNIOR YEAR

Inorganic Pharmacy (6)	4	Pharmacognosy (4)	4
Quantitative Analysis (Chem. 3)	3	Physiology (Biol. 3)	4
French	3	French	3
Physics (Phys. 1a)	3	Physics (Phys. 1a)	3
Bacteriology (Biol. 12)	5	Proximate Organic (Chem. 4)	4
	18		18

SENIOR YEAR.

Proximate Organic Analysis (Chem. 4)	4	Micros. Study of Po. Drugs (5)	2
Pharmaceut. Testing and Drug Assaying (7)	3	Physiological Chemistry (11)	2
Mineralogy (Chem. 12)	3	Materia Medica and Therapeutics (8)	4
Economics (Econ. 3)	2	Economics (Econ. 3)	2
Elective	4	Dispensing (9)	1
Thesis	2	Elective	3
		Toxicology (10)	1
		Thesis	3
	18		18

Art.

MRS. MARSHALL.

MRS. GAGE.

Upon entering the art department we find ourselves in a suite of spacious studios, occupying the one hundred-foot north front of College Hall, and lined with objects of art.

Here are many plaster casts from the antique, comprising, among other things, full length figures of the Venus of Milo, the Running Gladiator, and the Winged Victory. There are also portrait busts of Cicero, Sophocles, and other celebrated characters, and many masks of different types and nationalities.

There are many fine reproductions of the Barrie bronzes and other casts of animals, birds, flowers, and fruits. Many of the great styles of architecture and ornament are represented in plaster, from Egyptian down to the Renaissance.

We shall find many photographs from foreign countries, and reproductions of celebrated pictures in engravings and etchings. There is also a fine collection of works on art, suitable for class reading or serious study.

Among the other equipment for work the department has a china kiln of the largest size, in which the china painted by the classes is fired on the premises.

There are full sets of tools for wood carving, which are at the service of students, and an instrument for pricking and applying patterns for embroidery.

If we visit the studios during the class hours we find students working in many branches of art,—some in wood carving and clay modeling, some in painting on china, while in other rooms they may be drawing from the antique, painting in water-color, oil, or pastelle, studying applied design or taking lessons in perspective, or other work connected with the engineering departments.

Lectures on art often take the shape of imaginary tours in the great cities, and through the great galleries of the world, and are illustrated by pictures and stereopticon.

Attention is called to the regulation printed on page 17 regarding the keeping of work suitable for exhibition.

(1) **Drawing**—from the cast, in charcoal, crayon or pen and ink, still life and object drawing, sketching from nature, when the weather will permit. Study of plant forms, with suggestions for their application to design. In object drawing the pupil is required to study artistic grouping and good arrangement of light and shade. Memory and time drawing—blackboard work. I and II, 4.

(2) **Painting.**—Oil, water color, or pastelle. Prerequisite, 1. I and II, 6.

(3) **Freehand Drawing for Engineers.**—Perspective as applied to sketching from natural objects, freehand lettering, blackboard dictation, object drawing, with proper shading,, freehand drawing of machinery, use of water color in connection with mechanical work, study of architectural styles, tests for color signals. I and II, 4.

(4) **Drawing From Nature.**—Drawing and painting of plants and animals, intended especially for students in biology. It may be taken in either semester separately. I and II, 2—6.

(5) **Normal Work.**—This is a course in the training of the eye and hand and in the methods of teaching, intended especially for those who may be planning to teach art. Those who take this work will be allowed some opportunity for practice in teaching under the direction of the head of the department. I and II, 4—8.

(6) **Wood Carving and Clay Modeling.**—Tools and clay provided by the department.

(7) **Applied Design.**—Study of color schemes and color harmony, with historic ornament, leading up to practical designing for various handicrafts. Each student will occasionally submit original designs for embroidery, wood-carving, and other decorative work based upon natural forms. Courses I and 2 are prerequisite.

(8) **Figure Study.**—A life class open to all who show talent for drawing from the human form. Study of costume.

(9) **Painting on China.**—Students to be admitted to the work in china painting must satisfy the instructor that they have the necessary preparation to undertake the work profitably. China is fired in the studio. Courses 1 and 2 are prerequisite.

(10) **Art Lectures.**—Required of pupils taking certain courses but open to all students who may wish to attend them.

Biology

PROFESSOR COOLEY.

ASSISTANT PROFESSOR SWINGLE.

ASSISTANT PROFESSOR SPAULDING.

The biology department has been remodeled and occupies the whole of the building formerly used for the experiment station.

In the basement is a small class room, an herbarium room and rooms for storage. One large room is devoted to receiving and unpacking apparatus and supplies and for rough storage. The entire west half of the first floor is a large laboratory for the use of students. This is equipped

with large heavy tables, individual lockers and apparatus cases as necessary, and will accommodate twenty-five students. The east half of the first floor is occupied by the office of the department, a private laboratory for the station entomologist and a library.

The laboratories on the second floor accomodate about fifty students and are equipped with heavy tables with drawers. These rooms are supplied with gas and electric light. Individual lockers and cupboards for the convenience of students in bacteriology, physiology and general botany and zoology are in these rooms.

Opening off the bacteriological laboratory are a culture room for transferring bacteria without danger of contamination and an incubator room where an incubator and paraffin bath are maintained at a constant temperature.

A greenhouse attached to the building on the south side contains a laboratory and a small hothouse. This laboratory and greenhouse combined are for the exclusive use of classes in plant physiology and plant pathology and are especially constructed to that end. Both are under glass and are provided with cement floors that plants may be carried from one to the other without suffering change of environment. Opening out of the physiological laboratory is a large dark room, with double doors, equipped for experiments illustrating the action of light and darkness on the behavior and growth of plants.

The greenhouse is attractively furnished with plants, both ornamental and illustrative; and the laboratory has aquaria in which running water keeps algae and other aquatic plants growing the year round.

Among the more important pieces of apparatus available for work in the various branches of botany and zoology are the following:: Forty compound microscopes, seven of which are equipped with excellent oil immersion lenses of the best make in this country and Europe. Beside the regularly required lenses attachable to these microscopes are a fine series for special purposes, including those made especially for photomicrographic work; a Filar micrometer and several stage and eye-piece micrometers for the accurate measurement of microscopic objects; four dissecting microscopes with rack and pinion adjustment of the lenses, of which there is a series with each instrument; twenty-two very serviceable dissection microscopes of less expensive construction; one rotary microtome for rapid and fine work, one Minot automatic precision sliding microtome especially constructed for sectioning wood and well adapted for general work; a large supply of dissecting instruments; two paraffin baths with attachments for maintaining a constant temperature; a good working set of stains and other chemicals for histological work in both animal and vegetable tissues; two incubators with constant temperature attachments, serviceable in embryological and bacteriological work; one large size eclipse type of autoclave, the most up-to-date and serviceable of any

now available; one hot-air sterilizer of the large improved Lautenschlager type; one Koch sterilizer; one Arnold sterilizer; one Ganong Clinostat; one Draper self-recording thermometer; one Draper self-recording hygrometer; six auxonometers; photosythiscope; six warm stages.

Besides the pieces above listed the department owns a large quantity of general apparatus, glassware and chemicals, sufficient for giving, in a thorough manner, all the sub-courses listed in this department.

It is the purpose of the biological library to furnish the students with full and up-to-date knowledge of all zoological, botanical and bacteriological subjects taught at the college and such special subjects as may be taken up for research work.

Of the larger and more important works are Saccardo's "Sylloge Fungorum" for the identification of fungi; Engler's and Prantl's "Pflantzenfamilien." covering the entire plant kingdom; DeToni's "Sylloge Algarum" for the algae and the Kew Index and Briton and Brown's "Illustrated Flora of North America," relating to the flowering plants, and most of the more important classic and recent works on plant morphology, physiology and classification and on the various phases of bacteriology. There are also several hundred pamphlets dealing with special lines of botanical work, and a full set of bulletins of the state experiment stations and the U. S. Department of Agriculture, which are rich in research papers on botanical subjects.

To keep up with the most recent discoveries, we receive regularly a number of the best botanical periodicals published in this country and abroad, and we are constantly adding to our library as our special needs require.

The department is well equipped with necessary zoological literature. Special attention has been paid to accumulating titles relating to entomology and physiology, as well as general zoology. Among the more important books may be mentioned the following: General Insectorum (complete); Zoological Record, Entomological News (complete); Canadian Entomologist (complete); Zoologische Anzeiger, Anatomischer Anzeiger, Psyche (complete); transactions of the American Entomological Society. Besides these there are a large number of books treating of the various branches of zoological science. These, together with a large number of unbound pamphlets, constitute a good working library.

The department has purchased the entomological section of the Concilum Bibliographicum and is a subscriber to the additional cards. This catalogue and one of about 35,000 references, made by the department, are of great service in facilitating the library work of the students in entomology.

A large, well selected, and rapidly growing series of microscopical mounts, including histological preparations of animal and vegetable tis-

sues, bacteria and dissected parts of plants and animals is available for the use of students and is of great value in their instruction.

For preparing lantern slides, prints and other illustrative material for the students, for illustrating thesis and research papers and to acquaint the student with photographic methods, the biology department is provided with several good cameras. Among these are a 5x7 camera provided with a Bausch and Lomb make of the Zeiss convertible anastigmatic lens, series VII, a lens for general use, and a Bausch and Lomb photomicrographic outfit, including one special lens and two specially constructed microscope objectives. There are two dark rooms, one exclusively for photographic use and one in connection with the physiological laboratory used for photographic work during vacations and at other times when not in use by students in their experiments with plants. A good supply of chemicals for making the various developers, etc., is always on hand.

On the third floor, opposite the museum, is a well lighted lecture room which can be quickly darkened for the use of the electric lantern on a raised platform in the rear of the room. Fully one thousand lantern slides are in the department for use in illustrating the lectures. A large part of the Kny series of botanical charts in colors and in black and white, and a series of zoological charts after Leukart are also used with the lectures.

(1) **Invertebrate Zoology.**—Devoted to a study of the invertebrate animals, including their morphology, development, habits, economic or popular interest, and classification. The broad biological principles are brought out and emphasized. The class room work is based on "Galloway's First Course in Zoology." The laboratory exercises include a study of the morphology of types, reference reading and practical work in the classification of the animals. Required of agricultural and general science students except those in the mathematics and physics group. Lectures, 2; laboratory, 3. I, 5. Assistant Professor Spaulding.

(2) **Vertebrate Zoology.**—A continuation of (1), taking up vertebrate (chordate) forms. Required of agriculture and biology students. Elective for those who have taken (1). Lectures, 1; laboratory, 3. II, 4. Assistant Professor Spaulding.

(3) **Animal Physiology and Anatomy.**—By means of lectures and demonstrations the main principles of animal physiology are presented to the students, while in the laboratory they become familiar with the most important features of mammalian anatomy. Required of agriculture, home science, pharmacy, and biological students. Elective for general science students who have taken (1) Lectures, 2; laboratory, 2. II, 4. Assistant Professor Spaulding.

(4) **General Entomology.**—Lectures on the morphology, metamorphoses and classification of insects and a study of the various orders. Collecting, naming, labeling and arranging in museum form species that are to be found in the vicinity of Bozeman. Required of biology students.

Elective for others who have taken (1). Lectures, 2; laboratory, 2. II, 4. Professor Cooley.

(5) **Economic Entomology.**—A briefer account of the structure, metamorphoses and classification of insects, followed by an extended study of the general principles underlying insect depredations, together with an account of the more important insect pests of the garden, orchard and farm in Montana. Required of agricultural students. Lectures, 3; laboratory, 1. II. 4. Professor Cooley.

(6) **Advanced Entomology.**—This course is a continuation of the general entomology course (4), and is made up of reading and conference work and of laboratory exercises. Students in this course will be assigned work best suited to their special requirements. Forestry students will take up a detailed study of the insect pests of the forest, while regular biology students will be assigned more technical subjects. All laboratory work. II, 1 to 5. Professor Cooley.

(7) **Household Economic Entomology.**—Lectures on insect life injurious to food materials, clothing, carpets, draperies, etc. Required of college students in home science. Open to other lady students in the general science courses. Lectures. II, 2. Professor Cooley.

(9) **General Botany.**—Morphology, anatomy and elementary physiology of plants, including life history studies of all the groups. The fundamental biological principles are here laid down on which all higher botanical studies are based. Required of all science and agriculture students. Lectures, 2; laboratory, 3. I, 5. Assistant Professor Swingle.

(10) **Plant Physiology and Histology.**—Experimental work in the movement, growth, nutrition and reproduction of plants with a microscopical study of the structure involved. Must be preceded by biology (9) and 1st sem. of chemistry (1). Required of agriculture and biology students. Lecture, 1; laboratory, 3. II, 4. Assistant Professor Swingle.

(11) **Plant Pathology.**—General facts and principles governing the health and disease of plants, with illustrative experiments, followed by a study of the classification ,morphology, and special physiology of parasitic plants, with especial reference to diseases of cultivated crops in Montana. Must be preceded by (9) and (12). Required of agronomy and horticulture students. Lectures, 1; laboratory, 3. II, 4. Assistant Professor Swingle.

(12) **Bacteriology.**—A study of the structure, life history and classifications of bacteria, their growth in nutrient media, and methods of bacteriological technique. The relation of bacteria to agriculture, disease, and our daily life is discussed. Must be preceded by biology (9) or (3) and chemistry (1). Required of agriculture and home science students. Lectures, 1; laboratory, 3. I. 4. Assistant Professor Swingle.

(13) **Embryology.**—An introductory course in embryology, embracing a study of the formation and growth of tissues in the vertebrate

body, based chiefly on a study of the chick, but including consideration of the development in the mammalia. Open to students who have completed biology (2) or (3). Lecture, 1; laboratory, 3. II, 4. Assistant Professor Spaulding.

(14) **Organic Evolution.**—A discussion of the general principles underlying the science of biology, including such topics as: inheritance, heredity, variation, distribution and origin of species, and the history and development of the evolution theory. Lectures, recitations, and assigned reading. Open to students who have completed at least two courses in biology. Lectures, 2. II, 2. Assistant Professor Spaulding.

(15) **Forest Botany.**—A thorough study of types of trees and identification by means of leaves, twigs, flowers, fruits, seedlings, etc. The ecology of woody plants is treated with especial reference to moisture and altitude best suited for growth. Lectures. 1; laboratory, 2. I, 3. Assistant Professor Swingle.

(16) **Forest Technology.**—Gross anatomy and histology of woody stems with special relation to the strength, beauty and quality of the wood for technical purposes. Tests of the strength of different woods and methods of cutting and finishing are studied experimentally by the students. Lectures, 1; laboratory, 2. II, 3. Assistant Professor Swingle.

(17) **Thesis.**—Students in the biology course in their senior year and seniors from other courses, who have had sufficient previous training in biology, may devote a maximum of five credits per semester in thesis work, under the direction of Professor Cooley or Assistant Professors Swingle or Spaulding.

Chemistry

PROF. COBLEIGH.

ASS'T. PROF. BURKE.

MR. ROBINSON.

The applications of chemistry to the various phases of agriculture, to engineering and to many modern industries, makes this science an important one in a technical school. The fundamental courses of the science should be thoroughly taught in order that the student may have sufficient training and independence to apply his knowledge to practical operations. If the student is to master the principles of chemistry and at the same time obtain a working and practical knowledge of chemical manipulation, he must have certain facilities at his disposal.

Below is given, somewhat in detail, a description of the equipment and the conveniences provided for the study of chemistry in this institution:



BOTANY LABORATORY



BACTERIOLOGY —OFFICE OF ENTOMOLOGIST.

The lecture room, with raised floor and seating capacity for one hundred and fifty students, has a lecture desk provided with water, gas, and electricity, a demonstration balance and a stereopticon for showing the applications of the science. The class room exercises in general and applied chemistry are illustrated by experiments, lantern slides, and in many cases by exhibits of the raw materials and finished products of commercial processes. The lecture room equipment is in an adjoining room, which also serves as a private laboratory.

There are five laboratories equipped for the following lines of work: General chemistry, qualitative and quantitative analysis, organic and food chemistry, physical chemistry, and assaying. All desks are provided with water, gas, electricity, and filter pumps where needed. The hoods in each laboratory are furnished with gas and water and connections from a large Parson's hydrogen sulphide generator which will supply forty jets at one time. In each hood there are large steam and air baths, in operation at all times, being connected to the steam heating plant. The building is well ventilated by means of a mechanical draft, and heated by a direct indirect steam system. With some of the classes working in sections the laboratories will accommodate 150 students.

The store room is stocked with an ample supply of the apparatus and chemicals needed for the various laboratory courses. The student secures what equipment he needs from time to time in addition to that always kept in his desk, from the store keeper, who is on duty at convenient and stated hours. The equipment includes, besides the usual stock of apparatus, much that is designed for special use, such as accurate balances for both quantitative analysis and assaying, standard weights, equipment for calibrating measuring apparatus, polariscopes, Abbe refractometer, oil testers, apparatus for water, air, and gas analysis, combustion furnaces, Hoskin's crucible and muffle furnaces for assaying and for experiments necessitating high temperatures, apparatus for gas density determinations, and Beckman's freezing and boiling point apparatus, and equipment for conductivity measurements, etc.

The department museum occupies a well lighted room in the basement. In this room are stored in cabinets, and glass exhibit cases, the collections illustrating chemical industries of various kinds, and the mineralogical and geological specimens. The mineral collection is quite extensive. It includes a valuable private collection purchased by the college some years ago. To this was added a part of the Montana mineral exhibit at Chicago in 1893, and large additions have been made from time to time through exchanges and purchases. The collection is thoroughly representative and forms an important adjunct to the chemical department.

The chemical library and office is located on the first floor and contains full sets of the American Journal of Science, Journal of the American Chemical Society, Journal of the (London) Chemical Society, Berzelius

Jahresbericht, Bericht der deutschen Chemischen Gesellschaft, and Fresenius Zeitschrift fur Analytische Chemie. There are also partial sets of Chemical News, and the Analyst. Besides these the library contains many standard reference works and the recent text books. There are also index volumes and card catalogues to facilitate more ready reference to the literature.

(1) **General Chemistry.**—Two lectures, one recitation and one 2½ hour laboratory period per week throughout the year on the fundamental laws of chemistry, the history, occurrence, preparation and properties of the common elements and their compounds. High school physics is prerequisite. Text books, Smith's College Chemistry and Lenher's Laboratory Manual. I and 11, 8.

(2) **Qualitative Analysis.**—Lectures and recitations two hours per week on the theory and practice of qualitative analysis, the properties of solutions, laws of ionization and mass action as applied to analytical chemistry. Laboratory practice two afternoons per week in the analysis of simple salts, complex mixtures, ores and minerals. Text books, Qualitative Analysis by Dennis and Whittelsey; Electrolytic Dissociation Theory by Talbot and Blanchard. Chemistry (1) is prerequisite. I, 4.

(3) **Quantitative Analysis.**—Two lectures and recitations per week during the second semetser of the sophomore year and one lecture during the first semester of the junior year. The class room work includes discussions on the theory and technique of the laboratory methods and chemical calculations. Five hours of laboratory work per week during first semester of the course and seven and one-half hours during the second semester. The analyses required include the following: Magnesium sulphate, potassium alum, iron ammonium alum, iron ore, limestone, clay or slag, zinc, lead, copper, manganese, arsenic, antimony, and nickel ores alkalimetry, acidimetry coal and flue gas. Chemistry (1) and (2) are prerequisite. Text books, Miller's Notes on Quantitative Analysis for Mining Engineers; Treadwell's Quantitative Analysis, and Miller's Calculations of Analytical Chemistry. II and 1, 8.

(4) **Proximate Organic Analysis.**—Lectures and recitations on the methods used for the analysis of organic substances and agricultural products. The laboratory portion of the course includes analyses of the following: Feeding stuffs and cereals, fertilizers, soils, sugars, milk, butter, oils, alcohol, glycerol, formaldehyde, and the detection of adulterations in food. Chemistry (3) and (5) are prerequisite. Text book, Proximate Organic Analysis by Sherman. II and I, 8.

(5) **Organic Chemistry.**—An elementary course designed to make the student familiar with the principles of organic chemistry and with the more important compounds of both the aliphatic and the aromatic series. Remsen's Organic Chemistry is used in the class room and the laboratory

work is based on the Holleman-Walker Laboratory Manual, and Gaetterman's Practical Methods of Organic Chemistry. Chemistry (1) is prerequisite. I and II, 6.

(6) **Physical Chemistry.**—A course in theoretical chemistry consisting of lectures, recitations, assigned problems, and laboratory work. The class room discussions include the following topics: The gas laws, thermodynamics, solutions, chemical mechanics, equilibrium in electrolytes, and electro-chemistry. The laboratory work includes vapor density determinations, freezing point, boiling point, and conductivity methods, etc. Text books, Morgan's Physical Chemistry for Electrical Engineers; Ostwald's Physico-Chemical Measurements. II, 4.

(7) **Agricultural Chemistry.**—This course is designed especially to meet the needs of students in the four year courses in agriculture. Three class room exercises per week are held for the purpose of studying the chemistry of the following topics of importance to an agriculturist: The soil, manures and fertilizers, constituents of plants, animal products, foods and feeding, milk and milk products. Text books, Ingle's Manual of Agricultural Chemistry. Laboratory work three afternoons per week, making analyses which include the following: Magnesium sulphate, potassium alum, iron ammonium alum, limestone, soil, cereal or feeding material, fertilizer, milk and butter. Chemistry (2) and the first semester of chemistry (5) are prerequisite. Text book, Lincoln and Walton's Quantitative Analysis for Students of Agriculture. II, 6.

(8) **Food Chemistry.**—Arranged for students in the junior year of the home science course. Class room discussions on the chemical composition of different foods, and their functions, the preservation and adulteration of foods, supplemented with appropriate laboratory exercises designed to emphasize the class work. The first semester of chemistry (5) is prerequisite. Text book, Sanitary and Applied Chemistry by Bailey. II, 3.

(9) **Industrial Chemistry.**—Lectures, recitations, and assigned reading on the industrial applications of chemistry. The topics considered will depend, to a certain degree, upon the purposes of the students who take the course. In general it will include fuels, refractory materials, limes, mortars, and cements, building stones, timber and its preservation, the properties of iron and steel, the treatment of the ores of lead, gold, silver, and copper, illuminating gas, explosives, etc. Chemistry (3) or (7) and (5) are prerequisite. I, 5.

(10) **Water and Air Analysis.**—A course designed for students in sanitary engineering. The sanitary analysis of water and air, with discussions on the proper interpretations of analytical results. The first semesters of chemistry (3) and of chemistry (5) are prerequisite. Text books, Mason's Water Supply, and Richard and Woodman's Air, Water and Food. II, 2.

(11) **Animal Nutrition.**—Lectures on the functions of fats, carbohydrates, protein, and salts in nutrition together with a study of the chemistry of digestion and metabolism. The first semester of chemistry (5) and chemistry (7) are prerequisite. II, 3.

(12) **Mineralogy.**—Blowpipe analysis, elementary crystallography and determinative mineralogy. Lectures and laboratory work. Text book, Moses and Parson's Mineralogy. I, 3.

(13) **Assaying.** — Conferences, recitations, and laboratory work. Testing the purity and reducing power of fluxes, fire assay for lead, gold, and silver ores, and gold and silver bullion, chlorination assay, cyanide and amalgamation tests. Chemistry (3) and (12) are prerequisite. Text book, Fire Assaying by Fulton. II, 4.

(14) **Seminar Abstracting.**—In order to develop in the student a habit of careful reading, each student will be required to make abstracts of articles on assigned subjects from the leading journals, and present them at weekly meetings of the students and department instructors, where the topics are freely discussed. Students are thus kept in touch with the progress of the science. I and II, 1.

(15) **Thesis.**—Students in the chemistry course are required in the senior year to prepare a graduating thesis on some subject which will involve considerable laboratory work and as much originality as possible. I and II, 4.

English

PROF. BREWER.

The library has abundant equipment for all the work offered in English. There are complete standard texts of practically all the authors referred to in any of the courses. Besides these there is a fair supply of biographical, critical and historical works, sufficient for ordinary reference use. The library equipment is complete enough so that thus far students have been able to do the reading assigned without the necessity of purchasing many books.

Though many classic novels are to be found on the shelves, no effort has been made in the college library to provide current English fiction.

In all the courses in English, written work plays an important part. That this work may be kept up to a proper grade, it is announced here that in college English work no paper will receive any credit that shows notable carelessness or ignorance in elementary matters of punctuation, grammar, rhetoric, or in the spelling of common words.

(1) **English Composition.**—This course is required of all freshmen. This course is almost altogether practice in various types of prose composition, narration, description, exposition, criticism, and argumentation.

The class meets ordinarily twice a week. The instructor from time to time meets each each student for private conference about his work. Lectures. I and II, 4.

(2) **Expository Composition.**—This is a course in expository writing for those students who are specializing in other subjects. Papers not extremely technical, prepared for work in other courses, may also be handed in as part of the work of this course. Lectures. I and II, 4.

(3) **Advanced Composition.**—This is an advanced course for those who wish to study composition as a fine art. It will include a study of the historical development of English prose style and such other work as may suit the taste or needs of those who elect the course. Lectures. I and II, 4.

(10) **English Literature.**—A reading course in English literature including about twenty of the more important authors from Chaucer to the present day. A large amount of reading is required and more recommended. Written reports on the reading are frequently required. A part of the class room time may be given to critical reading of English masterpieces. Lectures and recitations. I and II, 4.

(11) **English Essayists of the Nineteenth Century.**—A study of the more important essayists from Charles Lamb to R. L. Stevenson. Lectures and recitations. I and II, 4.

(12) **Shakespeare.**—A careful reading of three plays in the class room, and outside reading in other plays of the period. Lectures and recitations. II, 4.

(13) **Victorian Poetry.**—A study of the poetry of the Victorian period, with special reference to the work of Alfred Tennyson, Robert Browning, and Matthew Arnold. Lectures and recitations. I and II, 4.

Geology

PROF COBLEIGH.

The vicinity of Bozeman is an excellent locality for the student of geology. It affords many opportunities for studying the action of forces now in operation and also for observing the effects these forces have produced in the past. The geology of this locality has been worked out by the U. S. geological survey and the survey publications are in the college library.

The college museum contains excellent collections of minerals, rocks; and fossils, which are used for class room study. A set of lantern slides is used for illustrating the lectures.

(1) **Geology.**—Lecture, recitations, and assigned reading on dynamical and structural geology. Text book, Scott's Introduction to Geology. Chemistry (1), prerequisite. II, 3.

History

MISS BREWER.

The department has a set of MacCoun's historical charts of the United States and two sets of historical geography charts of Europe by the same author; Johnson's series of maps of ancient geography; ten of Bretschneider's maps of medieval Europe; and a set of maps of the modern world.

The library contains the laboratory of the historical department, but a catalogue of the histories would be too voluminous to include here. In Greek and Roman history, besides the standard narrative works, there are translation of the best source material for this period. For English history the library is well equipped with general works and has source material including Colby, Lee, and the University of Pennsylvania collection, Evelyn's Diary, a file of "The Gentleman's Magazine," etc.

Naturally the works on the United States history are the most numerous. The standard general histories, as well as works on limited periods or regions, and the best biographies of American statesmen, are in the library. The reports of the American Historical Association, and the Congressional Records, come to the library. There are also many contemporary records, among which are the Old South Leaflets, Hart's American History Told by Contemporaries; the complete works of Jefferson, Hamilton and other statesmen, and the Jesuit Relations.

(1) **European History.**—It is taken for granted that the student has had a preparatory course in general history, with some such text as Myers or West. In this course special attention is paid to English history, and the student's work is supplemented by lectures on the development of continental Europe. Cheyney's History of England and Kendal's Source Book are texts in the hands of the class, and special topics with library references are occasionally assigned. I and II, 4.

(2) **Medieval History.**—The student is supposed to have had courses which have given him knowledge of the great epochs in history and their relations to each other. Therefore, in this course he will take up the thorough history of one period. He will be encouraged to form his own opinions by the use of such historical sources of this period as are available in translations. In this connection the student will be given practice in application of the fundamental rules used in testing the value of historical material. I and II, 6.

(5) **American History.**—This is a course in United States history covering the period of constitutional development and with special reference to that development. The use of the library rather than any text book is required in this course, and the student is expected to spend about one-fourth of the time in the preparation of a paper on some selected subject. Course 2 should precede this course. I and II, 6.

(6) **Thesis.**—For research work in his senior year the student is allowed to select any historical subject which he is qualified to investigate; and for which some material is available either in translation or original.

Home Science

MISS HARKINS

MISS BALLINGER.

MISS LUCILE BREWER.

The third floor of the new agricultural building is occupied by the home science department. In the north end are two kitchens, one on either side of the hall. One, 34x26 feet, has two coal ranges, several electric stoves and desks for 16 students. The other, 27x26 feet, has one coal range and fourteen desks, fitted with individual gas stoves. All tables are well supplied with cooking utensils. Off from the east kitchen is a model dining room, and beyond it the department office. With the other kitchen is a student lunch room, 25x23 feet, connected by folding doors with the class room. There are also store rooms, pantries and cold storage rooms.

In the south end of the building is a large sewing room, 47x31 feet, with a class room, 31x16 feet, two small fitting rooms, and cases for the work of 100 students. Connected with these are an office, a class room, model bed room, and reception room. The department has eight sewing machines of various makes, two electric irons, cases for exhibition work, and large and small work tables.

(1) **General Cookery.**—The object of this course is to teach plain cooking,—breads, meats, soups, salads, vegetables, and simple desserts. Special attention is given to table decoration, and serving of meals. Two practice hours and one demonstration each week. Required of all freshman girls. I and II, 4.

(2) **Food Principles.**—A study of the classification of foods with regard to composition, digestibility and preparation. Lectures on marketing and care of supplies. Required of all freshman girls in home science course. II, 2.

(3) **Economic Uses of Food.**—Special attention is given to the economic side of the food question. Required of sophomore girls in home science course. One lecture and one laboratory period each week. I and II, 4.

(4) **Home Architecture and Sanitation.**—The surroundings, situation and plan of the house, heating, lighting, plumbing, and drainage. Two lecture periods. Required of all junior girls in home science course. I, 2.

(5) **Home Nursing and Invalid Cookery.**—Required of all junior girls in home science. II, 2.

(6) **Final Demonstration.**—Each student prepares a breakfast or luncheon for public demonstration. Required of senior girls in home science course. I and II, 2.

(7) **Journal Meetings.**—Topics relating to home science are assigned and discussed. Required of senior girls in home science. I and II, 4.

(8) **Practice Teaching.**—Senior students are given work as student assistants. Laboratory and lectures. I and II, 4.

(11) **Sample Stitches.**—Plain and machine sewing. At least two aprons, four pieces of underwear, two shirt waists, and a house dress must be completed. This work is required of freshmen in home science course. I and II, 4.

(12) **Garment Making.**—Drafting waists and plain skirts. Three shirt waists and one dress must be made. Laboratory. I and II, 4.

(13) **Dressmaking.**—Shrinking, pressing and making wool garments. One woolen dress and one cotton dress for afternoon or evening wear must be made. Laboratory. I and II, 5.

(14) **Dressmaking.**—During this semester the graduating dress must be made. Laboratory. II, 2.

(20) **Thesis.**

Latin

PROF. BREWER.

(1) **Virgil.**—Six books of the Aeneid are read. Metrical reading of Latin is required constantly. The students are encouraged to make metrical translations and paraphrases. Recitations. I and II, 8.

(2) **Livy and Horace.**—The special aim in this year's work, as in the previous course, is to enable the student to acquire facility in reading and a literary appreciation of the authors read. Recitations. I and II, 4.

Mathematics

PROF. TALLMAN.

MISS BULL.

The students in this department have access to the following journals: American Journal of Mathematics (complete set); Annals of Mathematics (from 1900); Bulletin of American Mathematical Society (1898 to date); and Transactions of American Mathematical Society (1898 to date), also about 200 volumes of recent treatises on mathematics. It may also be mentioned that our library is especially well equipped in treatises and journals of applied mathematics found in libraries of the engineering and physics departments.

(1) **Algebra.**—Beginning with a review of radicals and quadratic



COOKING CLASS.



DINING ROOM.

KITCHEN.

equations, the course includes progressions, arrangements and groups, binomial theorem, theory of limits, undetermined co-efficients, logarithms, and an introduction to the theory of equations. I, 3.

(2) **Plane Trigonometry.**—For engineering and science students. I, 2.

(2a) **Plane Trigonometry and Logarithms.**—For agricultural and home science students. I, 3.

(3) **Analytical Geometry.**—Straight line and conic sections, with an introduction to the geometry of three dimensions. II, 4.

(4) **Calculus.**—Both differential and integral, with applications to as many practical problems as possible. I and II, 10.

(5) **Method of Least Squares.**—I, 2.

(6) **Theoretical Astronomy.**—Integration of equations of motion, computation of orbits and ephemerides. This course should be preceded by course (5) in physics and must be preceded by course (4) in mathematics. I and II, 6.

(10) **Differential Equations.**—Ordinary and partial differential equations with geometrical and mechanical applications. I and II, 6.

(11) **Partial Differential Equations of Mathematics - Physics.**—This course will be based on Weber's "Die Partiellen Differential Gleichungen der Mathematischen Physik," and Byerly's "Spherical Harmonics." A great many applications to concrete problems will be made throughout the course. I and II, 6.

(12) **Newtonian Potential.**—Lectures on the theory of potential, with an introduction to spherical harmonics. I and II, 4.

(13) **Algebra (Advanced).**—This course will be an extension of course (1), and will contain discussion of complex numbers, theory of algebraic functions, etc. Care will be taken to show the practical application of each subject as the work advances; that is, such subjects as the connection between complex numbers and alternating currents, etc., will be fully explained. I and II, 6.

(14) **Analytical Geometry (Advanced).**—This course is a continuation of course (3). As the time given in course (3) for geometry of three dimensions is very limited it will receive considerable attention in this course. I and II, 6.

(15) **Thesis.**—Students specializing in mathematics are required to present a thesis on some chosen subject. The subject must be chosen and approved not later than November 15 of the senior year. A great deal of work in this line is desired, as it is believed there is no better way of developing a habit of independent thought.

(16) **Mathematico-Physical Seminar.**—During the year students and members of the faculty, especially interested in these subjects, will meet once a week to review articles of interest in the current magazines, to present from time to time results of original research which is being carried on, etc. Students in the mathematical group are required to attend.

Only a selection of courses (10) to (14) will be given each year, those being chosen for which most students apply. The special object of our work here is to make the courses in applied mathematics complete, and the work in pure mathematics will have as its object the laying of a good foundation for the more advanced work in applied mathematics. Those desiring to do work which is not offered in the above courses may consult the professor in charge of the department.

Modern Languages

PROF. CURRIER.

MRS. HALL.

The modern language department is well represented in the college library. The list includes the standard works in German and French literature in the original, as well as complete translations of the more important writers.

Many works of historical and critical nature and a number of standard lexicons may also be consulted. Several foreign language periodicals are at the disposal of students.

(1) **French.**—The study of French is begun in the freshman year, and the first year's work includes a thorough study of the elements of grammar, careful reading, with translation, of 300 pages of easy French, composition, practice in pronounciation and oral reading. Fair facility in sight reading is expected at the close of the year. I and II, 8.

(2) **French.**—In the sophomore year, in addition to easy texts and further study of grammar and composition, the classics, prose and poetry will be read, and also some scientific French, thus cultivating in the student an apreciation of the best foreign literature. The chief aim of the course is the acquisition of practical reading knowledge. I and II, 6.

(3) **French.**—An elective course in the French classic drama and nineteenth century fiction is offered to juniors and seniors. I and II, 6.

(10) **German.**—This course is open to college students who have not had high school or preparatory German. The work of the first year includes careful study of the elements of grammar, composition, pronunciation, conversation, the reading of easy texts, and sight reading. I and II, 8.

(11) **German.**—A continuation of the above course. The work consists largely of reading of a practical nature, with some introduction to the classics. Further attention will be paid to grammar and composition. If requested, scientific German will be read. I and II, 8.

(12) **German.**—The freshman work in German is a continuation of the course offered in the preparatory department, and can be taken only by students who have had two years of German previously. The classics

will be studied; also, scientific texts if desired, and some attention will be given to composition and conversation. I and II, 8.

(13) **German.**—An elective course offered to those who have completed course 11 or 12. It consists chiefly of advanced reading of a practical, scientific or literary character, as the needs of the students electing it may dictate. I and II, 4.

Pharmacy

MR. MOLLETT.

For the description of the work in pharmacy see the numbered paragraphs under title School of Pharmacy, in the later pages of this catalogue.

Philosophy and Economics

PRESIDENT HAMILTON.

(1) **Psychology.**—This course presents a general view of modern psychology and is required of all general science students. It gives a practical exposition of the materials and methods of psychological investigation. The lectures are accompanied by class demonstration. Attention is given to such topics as the growth of the central nervous system, the nature of consciousness, sensory and motory training, the higher intellectual faculties, and the will. So far as possible the work is made practical and concrete. I, 3.

(2) **Ethics.**—The work in ethics includes a study of the evolution of conduct, moral standards, the social and industrial life, the development and trend of ethical thought and an examination of utilitarianism. Required of general science students. II, 3.

(3) **Economics.**—This course consists of a study of such questions as land, capital, labor, money, coinage, banking, rent, interest, wages, and taxation. The most important questions in economics of the present time are considered. Among these may be mentioned trusts, labor organizations, government ownership of public utilities, co-operation, recent currency legislation, and the single tax. Required of science students. I and II, 4.

(4) **International Law.**—Woolsey's text book is used, but is supplemented by lectures and library work. In addition to the study of the principles of international law, an examination is made of treaties and the findings of international congresses. A practical study is made of the important questions in which our own government is especially interested, such as the Monroe Doctrine, the Eastern question, international arbitration, etc. Elective, II, 3.

Physics

MR. HAM.

The science of physics is fundamental to many of the technical studies taught in the college. Therefore the chief purpose of the following physics courses is to provide a thorough training in the science itself and in the use of the scientific method of thought, to the end that the student may have an adequate preparation for the study of the technical subjects in agriculture and engineering which are based on physical principles. The applications of the science are taught in so far as they do not interfere with the main purpose stated above.

The facilities at the disposal of the physics department are described below somewhat in detail.

The lecture room is located in the basement of the chemistry and physics building. The lecture desk is supplied with gas and both alternating and direct current circuits. A projection lantern is permanently set up and is used constantly to illustrate the class room exercises. A large collection of lantern slides has been prepared, which cover the whole subject of physics. The apparatus for lecture demonstration has been carefully selected and is sufficiently complete for giving experimental illustrations of all the principles of the science that are usually included in college courses.

For laboratory instruction three well lighted and conveniently furnished rooms are provided on the second floor of the building.

One of these rooms is equipped for electrical measurements and is wired with both alternating and direct current circuits, conveniently arranged for experimental purposes. The galvanometers are permanently located in convenient positions. The following forms are available: tangent, astatic, Thompson, differential, Northrup, and eight forms of the D'Arsonval type, including two with ballistic suspensions. In addition to the above equipment the following instruments are used in the various experiments taught, viz: magnetometer, standard resistances and condensers, Carhart-Clark cells, wire and box forms of the Wheatstone bridge, Carey Foster bridge, Callendar and Griffith's bridge, rheometer, electrodynamometer, ammeters, voltmeters, Leeds' potentiometer, platinum thermometer, thermocouples, earth inductor, standard solenoid, and rings of iron wound with wire for experiments in magnetization and hysteresis.

The second laboratory is furnished and equipped for teaching mechanics and heat. The equipment includes the following: micrometer and vernier gauges, spherometer, cathetometer, balances and weights, hydrometers, Atwood's machine, Young's modulus apparatus, torsion apparatus, torsion pendulums, apparatus for resolution and composition of forces, impact, harmonic motion, principle of moments, centrifugal force, and surface tension; simple and Kater's pendulums, a laboratory clock, ther-

mometers, air thermometer, calorimeters, expansion apparatus, hygrometers, Searles' mechanical equivalent of heat apparatus.

The third laboratory is used for the study of light and sound and also for the elementary classes in the preparatory schools. The equipment for teaching light and sound includes the following: a photometer, two spectrometers, spectroscope, mirrors, prisms, lenses, diffraction gratings, optical bench, Fresnel mirror and bi-prism, apparatus for polarized light, microscope, telescope, and an Abbe refractometer, sonometers, Kundt's tubes, siren, Lissajous apparatus, and Helmholtz resonators.

For the study of radioactivity and allied phenomena, there is a large induction coil, a variety of Crookes' and X-ray tubes, Wilson electroscope, radium compounds, and other radio-active material.

The physics library is located in one of the laboratories for students' use. It contains many of the best text books and general works on physics, and the current numbers of the Philosophical Magazine, the Physical Review, Science Abstracts, Section A, and School Science and Mathematics.

(1a) **General Descriptive Physics.**—Two lectures and laboratory work two and one-half or five hours per week in mechanics, heat, electricity, sound and light. Physics (1a) is a prescribed study in the courses in agriculture, biology, and history-literature. Mathematics (2) is prerequisite. Text books, General Physics, by Crew; Laboratory Course, by Sabine; Laboratory Physics, by Miller. I and II, 6 or 8.

(1) **General Physics.**—Lectures, recitations, and assigned problems, three hours per week throughout the year on mechanics, heat, magnetism, and electricity. This course is more mathematical and technical than physics (1a) and is particularly designed to meet the needs of students in engineering and the science students in the mathematics-physics course. Students who have not completed the calculus, mathematics (4), are required to take it during the same year that physics (1) is taken. Text book, General Physics, by Hastings & Beach. I and II, 6.

(2) **Physical Measurements.**—A laboratory course designed to supplement physics (1). It is strictly quantitative and is given for the purpose of providing laboratory illustrations of fundamental principles of the science and to offer a training in making measurements of precision. Text books, Mechanics, Molecular Physics and Heat, by Millikan; Laboratory Physics, by Miller. I and II, 4.

(3) **Light and Sound.**—Lectures and recitations two hours per week on wave motion, the theory of light in its application to familiar optical phenomena and to optical instruments, and on the phenomena and laws of sound. Prerequisites, physics (1) and (2). Text book, General Physics, by Hastings & Beach. II, 2.

(4) **Physical Measurements.**—A laboratory course in light and sound to supplement physics (3). II, 2.

(5) **Electricity and Magnetism.**—Lectures, recitations and problems, two hours per week on the mathematical theory of selected portions of electricity and magnetism, electrical units and exact methods of measuring electrical quantities. Physics (1) and (2) are prerequisite. I, 2.

(6) **Electrical Measurements.**—A laboratory course supplementing course (5). It consists of exact measurements of resistance, electromotive force, current, capacity, and self-induction, calibration of commercial measuring instruments, insulation tests, battery testing, and magnetic measurements, including determination of the permeability and hysteresis of samples of iron. Requirements are the same as for course (5). I, 2.

(7) **Advanced Physics.**—Physics (7) is primarily a laboratory course and is offered as an elective to science and engineering students. Conferences and assigned reading are essential features of the course. A more complete study of the precision of measurements will be made than was attempted in physics (2) and a precision discussion will be a required portion of each laboratory report.

There are four separate parts to this course from which the work desired may be selected.

(a) **Heat.**—A study of exact methods of thermometry, pyrometry, calorimetry and determination of the mechanical equivalent of heat. Physics (1 and 2) are prerequisite. I or II, 3.

(b) **Light and Radioactivity.**—Conferences, assigned reading and a series of standard laboratory experiments to illustrate diffraction, interference and polarisation of light, spectroscopy, photometry, conduction of electricity through gases, and the phenomena of radioactivity. Physics (3 and 4) are prerequisite. Not offered in 1909-10. II, 3.

(c) **Electricity and Magnetism.**—This course will be arranged to suit the needs and purposes of individual students. It is offered as an elective in the science and electrical engineering courses to those who wish to continue the subject beyond the requirements of physics (5 and 6). I or II, 3.

(d) **Manipulation and Construction of Apparatus.**—This is primarily a course in processes useful in the laboratory and includes glass blowing, cutting, grinding, and polishing, preparations of fibres for suspensions, silvering glass, purifying mercury and photography, including copying, printing and lantern-slide making. Practice is given in the construction, and setting up of apparatus suitable for both elementary and college courses in physics. In this connection there will be conferences and assigned reading on the more recent methods of teaching high school and college physics. Physics (1, 2, 3 and 4) are prerequisite. I or II, 3.

(8) **Thesis.**—Students in the mathematics-physics group who elect physics as their major subject, are required in the senior year to prepare a graduating thesis on some subject which will involve considerable laboratory work and as much originality as possible.

Political and Social Science

PROF. BREWER.

For these subjects the library has a fair supply of the best reference books, and material is available also from the best current periodicals, from bound sets of several magazines, and from the government reports, both state and national.

(1) **Constitution of the United States.**—One semester is given to the study of Bryce's American Commonwealth. The aim of the course will be to give a clear idea of the present day working of our government, and the problems that confront it; and to study intelligently contemporary questions of public life. Lectures and recitations. II, 2.

(2) **Sociology.**—The origin and history of human society, the various social theories and the laws of human intercourse are treated. Attention is given to such practical subjects as the government of cities, settlement work, the enrichment of country life, and charity work. Lectures and recitations. Elective, I, 3.

Public Speaking

MRS. HALL.

(1) **Public Speaking.**—Two hours a week throughout the year are devoted to the study of vocal expression and practical public speaking. A few recitation periods are given to a review of parliamentary law as a practical aid to all platform work.

Original material is required in extemporaneous speeches, debate and formal address.

The principles of artistic interpretation and platform oratory are developed by the study and presentation of literary masterpieces. In addition to this required class room work, students receive individual training from the instructor, in public speaking and intercollegiate debates, oratorical contests, dramatic recitals and plays. I and II, 2.

The Preparatory School

MISS MARY A. CANTWELL, Principal.

The preparatory school is maintained for the benefit of the young people who live in counties not having high schools ,or in the rural districts not convenient to the city high schools. With the large and well equipped kitchen, sewing rooms, shops and laboratories, the work ranks with that of the best secondary industrial schools. Many members of the college faculty give preparatory instruction in their special subjects.

For admission to the preparatory school the equivalent of an eighth grade certificate is required. Those not having eighth grade certificates will pass an examination in the common branches, or otherwise satisfy the principal before entering classes.

Military drill is required of the men and physical culture of the women.

A liberal course of reading is given in English classics as a part of the required work. It is desirable, so far as possible, for students to purchase the books and make them a part of their private libraries.

Judge F. K. Armstrong, of Bozeman, gives a prize of ten dollars to the one taking first place in an annual declamatory contest. There is also a prize of five dollars for the second best. Only regular students in the preparatory school are eligible to enter this contest.

Below are outlined three preparatory courses—the Scientific, as prescribed by the State Board of Education; and two industrial courses—Home Science and the Mechanic Arts. It will be noted that each of these courses includes the seven *units required from all candidates for admission to college, as shown on page 14. For admission to college fifteen units of work are required; but the following courses, planned to occupy full four years, are based upon a minimum of sixteen units. A suitable diploma will be given upon the completion of any one of these courses.

Irregular registration, except as necessitated by a student's previous work, is allowed by vote of the faculty only.

The subcourses in English, German, Latin, and Mathematics may be taken only in the order prescribed in the description of the work. Students who elect either German or Latin must take not less than two units.

*A unit consists of work to the amount of four sixty-minute recitation periods per week for thirty-six weeks. Two periods of laboratory, shop work, home science, or drawing, shall count as one recitation period.

SCIENTIFIC COURSE

FIRST YEAR

First Semester		Second Semester	
English Composition (a)	4	English Composition (a)	4
Algebra (a)	4	Algebra (a)	4
Greek History (a)	4	Roman History (a)	4
Freehand Drawing (a)	2	Freehand Drawing (a)	2
Mechanic Arts (Boys)	2	Mechanic Arts(boys)	2
Sewing (a) Girls	2	Cooking (a) Girls	2
	16		16

SECOND YEAR

Rhetoric (b)	4	Rhetoric (b)	4
Algebra (b)	4	Plane Geometry (c)	4
Art (b)	2	Art (b)	2
Take two of the following:		Take two of the following:	
Biology (a)	3	Biology (a)	3
Medieval History (b)	4	Modern History (b)	4
Latin (a)	4	Latin (a)	4
	17 or 18		17 or 18

THIRD YEAR

Literature (c)	4	Literature (c)	4
Plane Geometry (c)	4	Solid Geometry (d)	4
Physics (a)	4	Physics (a)	4
Latin (b) or German (a)	4	Latin (b) or German (a)	4
	16		16

FOURTH YEAR

Literature (d)	4	Literature (d)	4
Trigonometry (Math. 2a)	3	Physiology (b)	3
Latin (c) or German (b)	4	Latin (c) or German (b)	4
American History (c)	2	American History (c)	2
Reviews	4	Reviews	4
	17		17

HOME SCIENCE COURSE

FIRST YEAR

First Semester		Second Semester	
English Composition (a)	4	English Composition (a)	4
Algebra (a)	4	Algebra (a)	4
Greek History (a)	4	Roman History (a)	4
Freehand Drawing (a)	2	Freehand Drawing (a)	2
Sewing (a)	2	Cooking (a)	2
	16		16

SECOND YEAR

Rhetoric (b)	4	Rhetoric (b)	4
Advanced Algebra (b)	4	Plane Geometry (c)	4
Medieval History (b) or	4	Modern History (b) or	4
or Biology (a)	3	Biology (a)	3
Two or three of the following:		Two or three of the following:	
Art (b)	2	Art (b)	2
Sewing (b)	2	Sewing (b)	2
Cooking (b)	2	Cooking (b)	2
	16 or 17		16 or 17

THIRD YEAR

Literature (c)	4	Literature (c)	4
Plane Geometry (c)	4	Solid Geometry (d)	4
Physics (a)	4	Physics (a)	4
One or two of the following:		One or two of the following:	
*German (a)	4	*German (a)	4
Sewing (c)	2	Sewing (c)	2
Sanitation (c)	2	Sanitation (c)	2
	16 to 18		16 to 18

FOURTH YEAR

Literature (d)	4	Literature (d)	4
Take four or five of the following:		Take four or five of the following:	
German (b)	4	German (b)	4
Trigonometry (Math. 2a)	3	Physiology (b)	3
Sewing (d)	2	Sewing (d)	2
Cooking (d)	2	Cooking (d)	2
Reviews	4	Reviews	4
	15 to 19		15 to 19

*If German is elected in the third year, it must also be taken in the fourth year.

MECHANIC ARTS COURSE

FIRST YEAR

First Semester		Second Semester	
English Composition (a)	4	English Composition (a)	4
Algebra (a)	4	Algebra (a)	4
Freehand Drawing (a)	2	Freehand Drawing (a)	2
Mechanical Drawing (a)	2	Mechanical Drawing (a)	2
Wood work (a)	2	Woodwork (a)	2
Forge (b)	2	Forge (b)	2
	16		16

SECOND YEAR

Rhetoric (b)	4	Rhetoric (b)	4
Advanced Algebra (b)	4	Plane Geometry (c)	4
Medieval History (b) or	4	Modern History (b) or	4
Biology (a)	3	Biology (a)	3
Take 2 or 3 of the following:		Take 2 or 3 of the following:	
Freehand Drawing (b)	2	Freehand Drawing (b)	2
Mechanical Drawing (b)	2	Mechanical Drawing (b)	2
Forge (c)	2	Pattern Making (e)	2
Foundry (d)	1	Foundry (d)	1
	16 to 17		16 to 17

THIRD YEAR

Literature (c) or	4	Literature (c) or	4
German (a)	4	German (a)	4
Plane Geometry (c)	4	Plane Geometry (c)	4
Physics (a)	4	Physics (a)	4
Take two of the following:		Take two of the following:	
Mechanism (c)	2	Mechanism (c)	2
Machine (f)	3	Machine (f)	3
Cabinet Work (g)	3	Cabinet Work (g)	3
	16 to 18		16 to 18

FOURTH YEAR

Take 4 or 5 of the following:		Take 4 or 5 of the following:	
**Literature (c) or (d)	4	Literature (c) or (d)	4
German (b)	4	German (b)	4
Trignometry (Math. 2a)	3	Machine Design (d)	3
Steam Boilers and Practice (a)	4	Steam Engines and Practice (b)	4
Electrical Practice (a)	4	Electrical Practice (a)	4
Machine Work (h)	3	Machine Work (h)	3
Advanced Woodwork (i)	3	Advanced Woodwork (i)	3
	16 to 19		16 to 19

*If German is elected in the third year, it must also be taken in the fourth year.

**If Literature (c) is not elected in the third year it must be taken in the fourth year.

Description of Preparatory Work

ENGLISH.

(a) **English Composition.**—The aim of the course is to secure accurate and graceful expression, and to afford constant exercise in composition. In connection with this work English classics will be made the subject of class room study, forming a basis for the study of literature. I and II. 1 unit.

(b) **Rhetoric.**—This is a continuation of course (a). One hour a week is given to elocution. Each student is required to write at least one paper per week, based on text book work. I and II. 1 unit.

(c) **Literature.**—The object of this course is to develop an intelligent appreciation of American and English masterpieces and to promote a taste for the best literature. A series of classics similar in number and kind to the New England College requirements are the material for critical class room study. The student will find in the library valuable works of reference. I and II. 1 unit.

(d) **Critical Study.**—The purpose of this course is to apply the principles as laid down in composition and rhetoric. It will consist of a study of the classics, writing of themes, oral discussions and library and home reading assignments with a view to correct interpretation. I and II. 1 unit.

The following works are studied in class: Shakespeare's Merchant of Venice, and Macbeth; the Sir Roger de Coverley Papers from the Spectator; Irving's Life of Goldsmith; Coleridge's Ancient Mariner; Scott's Ivanhoe, and The Lady of the Lake; Tennyson's Gareth and Lynette, Lancelot and Elaine, and the Passing of Arthur; Lowell's Vision of Sir Launfal; and George Eliot's Silas Marner.

MATHEMATICS.

(a) **Algebra.**—This includes the following subjects: Addition, substraction, multiplication, division, equations of the first degree with one unknown number, simultaneous equations of the first degree, factors, highest common factor, lowest common multiple, quadratic equations, simultaneous equations above the first degree, theory of indices (positive, negative, fractional, and zero), and radicals. I and II. 1 unit.

(b) **Advanced Algebra.**—Simultaneous quadratic equations; ratio, proportion and variation, including graphical representation of simple relations between two variables; arithmetical and geometrical progressions; binomial theorem for positive integral exponents; logarithms, including use of tables in simple numerical work. I. ½ unit.

(c) **Plane Geometry.**—In this course special attention is given to

the geometry of the sphere. Prerequisite, algebra (a) and (b) and geometry (c). II. ½ unit.

SCIENCE

(a) Elementary Physics.—Lectures with experimental illustrations, recitations, assigned problems, and laboratory work three hours per week throughout the year in mechanics, sound, heat, light, electricity and magnetism. Text book, High School Physics, by Carhart and Chute, and Laboratory Notes, by Cobleigh. I and II. 1 unit.

(a) Biology.—This course will be conducted in such manner as to give the pupils a good understanding of the first principles of the science of living things. While the subjects of the course will be taken from the field of zoology and botany, it is not the purpose to train zoologists and botanists, but to equip the pupils, by the information and training given, to observe and interpret simple biological facts. Recitations and laboratory exercises. I and II. ¾ unit.

(b) Elementary Physiology.—An elementary course in physiology covering the main facts of general anatomy and physiology of the human body. Nutrition, the blood and circulation, respiration, excretion, nervous system and its functions, and the special senses are among the topics covered. II. ½ unit.

LATIN.

(a) Beginning Latin.—In the first year's work the aim is to secure a ready knowledge of the inflectional forms, the main rules of syntax, and a vocabulary which will prepare for easy Latin reading. For this purpose Hale's First Latin Book is used, which, in connection with grammatical study, gives reading lessons adapted to the ability of the learner. I and II. 1 unit.

(b) Latin Readings.—Drill similar to that of the first year in continued in this course in connection with the reading of easy selections from classic authors such as are found in Rolfe and Dennison's Junior Latin Book. This includes two books of Caesar and other reading, the equivalent of two more books. Prose composition exercises based on the text are also given. I and II. 1 unit.

(c) Cicero.—The four orations against Catiline are read, and two others. Roman politics ,as compared with those of our day, always interest students who have an intelligent interest in current events, and there is every opportunity for such comparative study in this work. Prose composition, based on the text, will be given in connection with this course, and the student will be given practice in sight reading. I and II. 1 unit.

GERMAN

(a) **Beginning German.**—The work of the first year is of the usual elementary nature, including study of grammar, composition, pronunciation, careful reading of easy texts and sight reading. I and II. 1 unit.

(b) **German Readings.**—The second year's work is also largely practical, but affords, as well, an introduction to classic German literature. The required reading during the two years is not less than 600 pages. I and II. 1 unit.

HISTORY

(a) **Greek and Roman History.**—The mastery of such a text as Myer's Ancient History or a briefer text on Greek and Roman history, with supplementary work in some such simple source collection as Fling's "Greek and Roman Civilization." Special attention is paid to the geography of the ancient world, and references to other books and occasional outside topics, are given to enable the students to grasp the subject rather than memorize the text. When possible, pictures of places or of objects of study are used. I and II. 1 unit.

(b) **Medival and Modern History.**—The second year is given to medieval and modern history, using the same methods and with similar alternatives. I and II. 1 unit.

(c) **American History.**—The study of American history with special reference to the expansion of territory and the development of industrial, social and civic institutions. Lectures supplemented by the use of sources and standard reference work. I and II. ½ unit.

DRAWING

(a) **Drawing.**—Freehand drawing from geometric solids and casts. Study of light and shade. Clay modeling. Object drawing. Study of plant forms with suggestions for their application to design. Memory and time drawing. Blackboard work frequently. I and II. ½ unit.

(b) **Drawing.**—Continuation of course (a) with increase of work in water color, wood carving, oil painting, etc. I and II. ½ unit.

COOKING AND SANITATION

(a) **Plain Cooking.**—Required of all preparatory girls in the first year. It is a study of breads, meats, vegetables and cereals. Two laboratory periods. II. ¼ unit.

(b) **Cooking.**—The work is both theoretical and practical. Williams and Fisher's text book is used. One lecture. One laboratory period. I and II. ½ unit.

(c) **Sanitation.**—The house site, surroundings, cellar, ventilation,

lighting, heating, plumbing, drainage, water supply general care of the house. Two lecture periods each week. I and II. ½ unit.

(d) **Bills of Fare and Cooking.**—In this course special attention is given to table setting and serving. I and II. ½ unit.

REVIEWS.

Reviews—In the scientific and home science courses a review of nine weeks each is offered in arithmetic, geography, English grammar and U. S. history. I and II. **1 unit.**

SEWING

(a) **Sewing.**—The work begins with the model work, which consists of making models in miniature, illustrating the various stitches used in general sewing and garment making. I. ¼ unit.

(b) **Hand and Machine Sewing.**—A continuation of models, and practice in making plain garments. I and II. ½ unit.

(c) **Drafting, Cutting and Making Garments.**—I and II. ½ unit.

(d) **Drafting Waists and Plain Skirts.**—Two waists and a house dress must be completed. Each student furnishes her own materials, as the garments made form a part of her own wardrobe. I and II. ½ unit.

MECHANICAL DRAWING AND DESIGN.

(a) **Mechanical Drawing.**—Lettering. The shape and proportions of letters, freehand construction. Freehand sketching of simple machine parts, reproduced in detailed working drawings. Orthographic projection in the third quadrant. I and II. ½ unit.

(b) **Mechanical Drawing.**—A continuation of (a) in detail drawing, tracing and blue printing. Shades and shadows, isometric drawing, simple mechanical perspective. I and II. ½ unit.

(c) **Mechanism.**—The elementary principles of the kinematics of machinery with such applications as to be of immediate utility in shop practice; the study of gears, screws, cams, bearings and quick-return mechanism. One hour recitation; two hours drawing per week. I and II. ½ unit.

(d) **Machine Design.**—A continuation of (c) in the study of bevel gears, gearing in train, roller bearings, belts and pulleys, rope and chain drive, together with tests of the strength of various materials. One hour recitation, four hours drawing per week. II, 3-8 unit.

Note: Course (d) above will not be given during the year 1909-10.

SHOP WORK.

(a) **Wood Work.**—Joinery, consisting of a series of exercises designed to develop skill in the use and care of bench tools, and proficiency in read-

ing simple working drawings. Turning, comprising spindle, face plate and chuck work in the manufacture of simple patterns and standard articles for shop use. House carpentry, illustrating the methods and principles of framing, rafter and stair cutting, mill work and finishing. Cabinet work, in which standard wood shop machinery is used in the manufacture of drawing tables, book and filing cases, office desks and other plain furniture, and including finishing in oil stain, wax and varnish. Taken with Mechanical Drawing (a). I and II. ½ unit.

(b) **Forge Work.**—The operation of hand and power forges and manipulation of the fire, with progressive exercises in iron forging designed to teach the operations of drawing, upsetting, bending, forming and welding. The work of the second semester includes the forging and welding of mild and tool steels, as well as the hardening and tempering of simple hand tools. With Mechanical Drawing (a). I and II. ½ unit.

(c) **Forge Work.**—A continuation of (b) in forging and tempering hand tools, lathe tools, foundry tools, springs, drills and reamers, including annealing and case-hardening. With Mechanical Drawing (b). I. ¼ unit.

(d) **Foundry.**—A course in bench and floor molding in green sand, progressing from the simplest to difficult cored work, with instruction in sweep molding, core making and cupola practice. Castings in white metal, brass and cast iron are poured for use in the machine shop. With Mech. Drawing (b). I and II. ¼ unit.

(e) **Pattern Making.**—Instruction in the methods of making proper allowances on patterns for draft, shrinkage and finish, and practice in the construction of patterns for pulleys, hangers, machine parts and pipe fittings, with the necessary core boxes. II. ¼ unit.

(f) **Machine Work.**—Bench work, including chipping, filing, scraping, fitting, soldering, brazing, and babbitting. Machine tool work at drill press, shaper, planer and lathe. I and II. ¾ unit.

(g) **Cabinet Work.**—A continuation of wood work (a) in the manufacture of furniture for the several departments of the college, with a study of the various woods and methods of finishing. I and II. ¾ unit.

(h) **Machine Work.**—Advanced work on lathe, milling machine and grinder. Hardening and tempering taps, dies, milling cutters and high speed tools. I and II. ¾ unit.

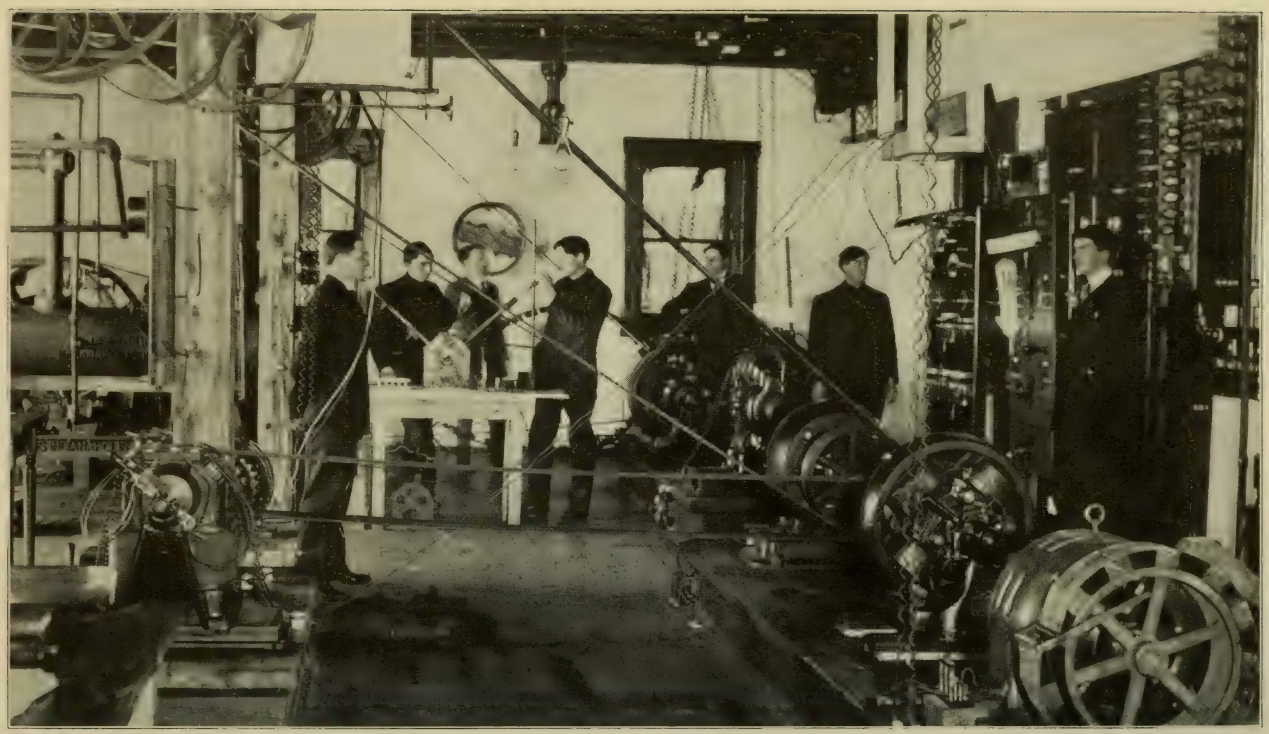
(i) **Advanced Wood Work.**—A continuation of cabinet work (g) in pattern or furniture construction, including instruction concerning the properties of fillers, oils, paints, stains, and varnishes. I and II. ¾ unit.

STEAM BOILERS AND ENGINES.

(a) **Steam Boilers and Practice.**—The construction and operation of steam boilers, and their auxiliaries, including the various boilers, their strength and evaporative capacity, the physical properties of steam, com-



LIBRARY.



ELECTRICAL LABORATORY.

bustion of fuel, pumps, injectors, feed water heaters, condensers. Prerequisites, physics, solid geometry, mechanical drawing (a), (b), and machine work (f). I. ½ unit.

(b) Steam Engines and Practice.—The construction and operation of reciprocating engines; valves and valve gears; governors; lubricators; indicator cards; indicated horse power; brake horse power; efficiency; belts and pulleys. Prerequisite, steam boilers (a). II. ½ unit.

Note: The work in steam boilers and engines will not be given during the year 1909-10.

ELECTRICAL PRACTICE

(a) Electrical Practice.—Elementary principles of electricity, electric wiring, management and care of electrical machines and apparatus, including dynamos and motors, batteries, electric lights, telephones and telegraph apparatus. Text book, Management of Electrical Machines, by Crocker and Wheeler. Prerequisites, Physics (a). Four lectures and recitations per week. I and II, 8.

School of Music.

F. ARTHUR OLIVER, Director.
Teacher of Piano and Harmony.

MISS REGINA BARNES,
Instructor in Piano.

MISS HELENA J. WALTER,
Instructor in Vocal Music.

GEORGE W. HEY,
Instructor in Violin.

LOUIS L. HOWARD,
Director of the Band and
Instructor in Band Instruments.

ADVANTAGES OF COLLEGE INSTRUCTION

The advantages of college over private instruction are very numerous and quite obvious to any one giving the matter serious thought. When a student is seeking the services of a private teacher, he must form his judgment as best he can on that person's fitness for his vocation, while it is certain that the teachers of a successful college are selected mainly on acount of their ability, as it would not be in the best interests of such an institution to sacrifice its reputation by employing other than good teachers. Again, the stimulating atmosphere of a music school is another distinct advantage over private instruction.

The music departments are organized for a four-fold purpose:

1. To combine music and literary studies as a broad basis for regular collegiate instruction.
2. To use the art of music as an intellectual, esthetic, and moral culture.
3. To teach all branches of music to special and general students.
4. To educate teachers of music.

DEPARTMENTS OF INSTRUCTION.

I. Course for the pianoforte.
II. Course for the voice.
III. Course for the violin.
IV. Course for harmony, counterpoint, analysis, and history of music.
V. Course for orchestral and band instruments.
VI. Instruction in chorus singing.

No time limit can be designated for the satisfactory completion of any course on account of differences in degree of musical ability; much also depends on the preparation made and upon the amount of time and careful attention the student can devote to the pursuit of a chosen study.

Students who present themselves as candidates for graduation must

give evidence of requisite musical talent and capacity. Each student must give, during the last year of study, one public recital, in addition to the final performance at the commencement concert. Students preparing for graduation are required to take two private lesons a week for two years, and it is necessary that resident stuaents should study with teachers of the college for at least two years. For graduation one semester's work in rudiments and four semesters' work in harmony will be required, and one year in the history of music.

The study of music has been placed upon an equality with other elective studies in the general science course, and a limited number of credits may be counted toward a degree. Diplomas will be granted to students who have done satisfactory work and passed the required examinations.

CALENDAR FOR 1909-1910.

The music department has divided the year into three terms, or, if desired, lessons may be arranged by the college semester.

1909.—Sept. 1, Fall term registration begins.
Dec. 7, Fall term closes.
Dec. 8, Winter term begins.
1910.—Mar. 15, Winter term closes.
Mar. 16, Spring term begins.
June 4, Spring term closes.

PIANO DEPARTMENT.

The course in pianoforte is covered by four grades, which are known as primary, junior, intermediate, and senior. Examinations will be held twice a year—at the end of each semester. Regular students may not pass from any grade to the next without examination. While it is not obligatory for students to take these examinations, yet they are encouraged to take them because they have something definite before them, their ambition is stimulated and a better quality of study is secured. The pieces used for these examinations will be chosen from a list arranged by the director of the music department.

Special attention will be paid to the following points in the examinations:

Excellence of technique.
Accuracy of notation and correctness of fingering.
Phrasing and rythm.
Discretion in use of pedals.
Choice of tempo and steadiness in time.
Quality of touch and tone.
Artistic interpretation.
Memory playing.
Playing at sight.

PRIMARY PIANO EXAMINATION

Candidates must be prepared to play from memory six pieces or sonatinas selected from a catalogue of pieces.

Technic.—Five finger exercises; all major and minor scales, hands separately, staccato and legato; triads in all keys; arpeggios in three positions, hands separately.

Studies.—Matthews' Graded Courses, Duvernoy op. 176, and Loeschhorn op. 65, or their equivalents.

JUNIOR PIANO EXAMINATION.

Candidates mut be prepared to play from memory eight pieces selected from the catalogue, one number of which must be by Bach. One number of the eight must be prepared without assistance.

Technic.—All scales, hands together, in quarter, eighth, and sixteenth notes, metronome at 69. Triads and four-note chords with different touches. Arpeggios formed on all major and minor triads with their inversions, metronome at 84, hands separately. Sttaccato octaves in any scale required.

Studies.—Czerny-Germer studies, Vol. I and II; studies arranged by Franklin Taylor; Heller, op. 45, 46, 47; Bach, Twelve Little Preludes and Inventions. Sonatinas and sonatas by Kuhlau, Clementi, and Dussek.

INTERMEDIATE PIANO EXAMINATION.

Candidates must be prepared to play from memory eight pieces selected from the catalogue, one number of which must be by Bach, one by Beethoven, and one by Chopin or Schumann. One number of the eight must be prepared without assistance.

Technic.—Major and minor scales, hands together, similar and contrary motion, metronome at 104. Also major scales, hands together, in thirds sixths, and tenths, metronome at 100. All chord forms. Arpeggios formed on the major and minor chords and on the diminished seventh chords, with inversions, metronome at 92 Staccato octaves in major and minor keys, hands together.

Studies.—Hassert, op. 50, Vol. I and II; Cramer, studies; Bach, preludes and fugues; Loew, octave studies; sonatas by Beethoven, Haydn, and Mozart.

SENIOR PIANO EXAMINATION.

Candidates mut be prepared to play from memory eight pieces selected from the catalogue, one number of which must be by Bach, one by Beethoven, and one by Chopin or Schumann. One number must be a concerto. One number of the eight must be prepared without assistance.

Technic.—All major and minor scales in octaves, tenths, sixths, and

thirds, metronome at 120. Scales must also be played with crescendos and diminuendos, two notes against three, and three notes against four. All chord forms, solid and broken, with any touch required. Arpeggios formed on all major and minor chords, also the dominant seventh, and diminished seventh chords, all with inversions, metronome at 108. All octave forms will be required.

Studies.—Etudes by Chopin and Haberbier; Bach. Well Tempered Clavichord; Clementi, Gradus ad Parnassum; Kullak, Octave Studies. Book II.

TUITION

(Payable in Advance)

With Mr. Oliver

For one forty-five minutet lesson per week, for one term.....$25.00
For two half-hour lessons per week, for one term 32.00

With Miss Barnes

For one forty-five minute lesson per week, for one term$13.50
For two half-hour lessons per week ,for one term 18.00

Tuition fees are subject to change from year to year.

Piano rent.—One hour each day, 30 cents per week.
Two hours each day, 50 cents per week.

Regulations.—No reduction will be made for temporary absence from lessons or for lessons discontinued. Lessons missed by the teacher will be made up at the mutual convenience of teacher and pupil.

All students must attend all regular meetings of the students' musical club and all public recitals.

The department is closed on the college and national holidays. Lessons falling on these days will not be made up.

HARMONY AND HISTORY

For the five semester's work required for graduation, Jadassohn's and Anger's Manuals of Harmony are used. A thorough drill is also given in notation—notes and rests, the staffs, clefs and ordinary musical signs; intervals, time, scales, transposition; and definition of musical terms. Students are trained to play cadences, sequences and modulations upon the piano. Matthews' Popular History of Music will be used for one year.

Fees.—$15.00 for the entire academic year, (one lesson a week).

VOCAL DEPARTMENT

The purpose of this department is to equip students for teaching and public singing. The solid foundation is laid by means of the Italian method. Italian sounds are used from the beginning as more conducive to free and natural tone production. The student is trained to a right

appreciation of this and to comprehension of breath control and direction, as the only sure guides to success.

Candidates for graduation must have completed a high school course or its equivalent, four years' voice work, one year each of Harmony, History of Music, Solfeggii and Normal Methods, must have some knowledge of modern languages and be able to play accompaniments.

The final examination shall consist of the singing from memory of an aria in a foreign language with not over two weeks' preparation, in addition to which the student shall give at least one recital and take part in the graduating program.

Technique studies and songs of the four years course are carefully graded and selected to meet the needs of the individual student. Some of the more important authors and composers are the following: Panorka, Abt, Sieber Concone, Nora, Luetgen, Viardot, Marchesi, Bona, Aprile, Vaccai, Vannichini, Tosti, Cowen, Chaminade, Mercadenti, Pinsuti, Donizetti, Rossini, Handel, Haydn, Mozart, Brahms, Schubert, Schumann, Franz and Verdi.

TUITION

(Payable in Advance.)

One forty-five minute lesson per week for one term.....$15.00
Two half-hour lessons per week for one term..... 21.00

Pupils wishing to arrange for instruction by the single lesson instead or by the term will be charged $1.50 per lesson.

No reduction will be made for any pupil who enters late in the term, or for temporary absence, or for withdrawal before the end of the term. In case of protracted illness, arrangements may be made at least a day before the lesson period.

VIOLIN DEPARTMENT

For beginners the First Part of the Violin Schools by either Louis Schubert, Carl Henning, Edm. Singer, or Herman, is used, and, when necessary, there are introduced easy arrangements of melodious pieces for violin with piano accompaniment, such as Melodien Sammlung, by H. Urban, etc., selections from easy duets for two violins, by Pleyel or Mazas. This is followed by Part II of Henning's Violin School; Kross' scales in two octaves; Studies, by H. E. Kaysor, op. 20, or first part of Gradus ad Parnassum, by Jacques Dont; and easy solos, by Allard, Hermann, de Beriot and others. Compositions for violins and piano are introduced as soon as practicable. Selections from the following are made acoording to the ability of the student: Dussek's Sonatas for piano with added violin part; sonatas for piano and violin by F. Schubert, Hauptmann, Haydn, and Mozart; Beethoven's Serenade op. 8, arranged for piano and violin, etc. Later, Part III of Henning's Violin School; Scales in Three Octaves, by

Fischel; Schradiesek's Violin Technic and Tonleiterstudien; the studies of Kreutzer, Fiorillo, Rovelli and Rode; Concertos, by Viotti, or Rode; Solos by David, Allard, DeBeriot; Duettos, by Viotti or Spohr. Lastly the 24 Etudes, by Gavine, Allard's 10 Etudes Artistique op. 19, and Abel's adaptation for the violin of Cramer's Famous Piano Studies; Concertos, by Mendelssohn, Beethoven, Spohr, Molique and Max Bruch; Sonatas for the violin, by Bach; Solos by Vieuxtemps, Ernst, Wieniawski, Saraste and other modern composers.

ENSEMBLE.

In this department, Sonatas for piano and violin by Bach, Beethoven, Mendelssohn, Schumann, Mozart, Haydn, Schubert, Grieg, Rubinstein and others are used; also many classical compositions of different forms. This department is open to advanced piano students only.

TUITION.

(Payable in Advance.)

One hour lesson per week, for one term	$23.00
Two half hour lessons per week, for one term.....	23.00
One forty-five minute lesson per week, for one term...	17.00

Terms.—For ensemble with violin same as for violin lessons.

Regulations.—Same as for piano department.

RECITALS.

Frequent instrumental and vocal recitals are given both by members of the faculty and students, the latter being thus enabled not only to cultivate their taste by hearing the best composers interpreted by the advanced students, but to develop their own powers of performance to the fullest extent.

Pupils studying in the elementary grades, are encouraged to play at the junior recitals, as soon as they are grounded in the primary requirements of touch, phrasing and conception.

Ensemble Class.—At the beginning of each year, ensemble classes are arranged. Students will find these classes very desirable and helpful, not only because they afford an opportunity of becoming better acquainted with the literature of concert music, but also because they insure a steadiness in playing and inspire confidence.

College Choristers.—The Glee Club consists of eighteen members under the leadership of Prof. Oliver. Students who have suitable voices for singing and who read music with sufficient facility are admitted. The club meets twice a week, preparing standard choruses and part songs from the classical and modern composers, which are given publicly from time to time.

College Band.—A band of forty pieces, under the instruction and leadership of Mr. Louis Howard, affords ample opportunity for all students who desire training in clarinet, cornet, trombone, French horn, and other band instruments. In addition to private and ensemble instruction, extensive practice is given in concerts and on public programs at college functions.

Student's Musical Club.—This organization has recently been formed by the teachers of the music department, the membership being open to all music students of the college. It meets every second Monday in the college assembly hall at four o'clock. At the meetings the lives of the different composers are studied and many of their works are analyzed and played by the students. This not only enables the students to cultivate their taste by hearing the best composers interpreted, but developes their power of performance and affords an opportunity to become acquainted with the best musical literature.

School of Art

MRS. MARSHALL.
MRS. GAGE.

The art department has a good equipment of casts in busts, masks, parts of the human figure, ornament and geometric solids; benches and tools for wood carving and clay modeling, a kiln for china firing, a perforating machine for transferring designs for embroidery, and photographic copies of sculptures and world pictures. There is also a splendid selection of books on art.

This work is intended to familiarize the student with the principles that underlie art, as well as with the practice of the various forms of art, chosen according to the taste of the student. Lectures are given on the principles and history of art, but the teaching is entirely individual. Among the forms of work offered are drawing, with attention to grouping, light and shade, perspective, clay modeling, wood carving, decorative designing, china painting, art embroidery, painting in oil or water colors, sketching from nature, figure study.

That the study of drawing is important in education is now universally acknowledged. Aside from the advantage to engineers, machinists, and architects, of a practical knowledge of draughtsmanship, the psychologic value of a knowledge of drawing is very great. The chief object of education is the quickening of the powers of the mind. Drawing brings out the power of analysis, habits of observation, qualities of judgment, imagination, memory and taste. It is something more than mere training of the eye. To achieve even moderate success requires that thought be put into every line. A line put down without thought is always a wrong line.



ART STUDIO.



SEWING ROOM.

Art, aside from anything we can produce, helps us to appreciate the works of great artists and opens our eyes to the beauty of form and color in nature. It extends our powers of enjoyment and gives us a better understanding of the history of the human spirit. It gives a proper gratitude for the work of great artists.

Students who are registered in the art course are admitted without further tuition fees to such other work of the college as their preparation will permit them to pursue to advantage. Attention is called in this connection to the work offered in history, literature, language, domestic science, music (which is charged separately), and in engineering and mechanic arts.

The art course, as here outlined, will indicate the work of the average student in a four year's course planned for those who attend mainly for the art work. All the talented being individual, the student is carried forward just as rapidly as his own talent and industry will permit.

Every effort is made to teach correct drawing. The pupil is then encouraged to apply such knowledge in any direction in which his talents may seem to lie, and is allowed the use of various mediums, such as oil, water color, pastel, etc., and also may take lessons in china painting. The classes in drawing and wood carving are open to students in any of the college courses.

Attention is called to the regulation, printed on page 17, regarding work done suitable for exhibition purposes.

FRESHMAN YEAR.

Drawing.—Drawing from the cast, in charcoal or crayon. Still life and object drawing. Drawing from plants and other natural forms in preparation for design. Sketching from nature, in the last few weeks of the second semester. In object drawing the pupil is required to study artistic grouping and good arrangement of light and shade. Memory and time drawing and blackboard work will be carried through the year.

Perspective.—Perspective and its practical application to the drawing of buildings, and to sketching from nature. Perspective problems to be worked out and carefully drawn. Water color tinting for mechanical work. Several art lectures each week. Clay modeling may be studied at the discretion of the teacher.

SOPHOMORE YEAR.

General Principles of Design.—Color schemes and color harmony. Historic ornament. Each student will occasionally be required to submit original design for embroidery, wood carving and other decorative work, based upon plant forms which he has drawn during previous years.

Painting.—The painting of plants and still life in oil or water color. Pen and ink drawing. Sketching from nature as the weather will permit.

JUNIOR YEAR.

Wood Carving.—An extended course in carving as applied to furniture and other objects. Lectures on the history of wood carving.

Figure Study.—In this year there is a life class, open to all who show talent for figure drawing. Study of costume. Painting in oil and water color. Lessons on decorations of interiors.

SENIOR YEAR.

Any branch of art preferred by the student. Otherwise further instruction in branches already begun. China painting may be taken up at the discretion of the teacher.

School of Agriculture

PROF. W. J. ELLIOTT, Principal.

The great majority of the young men in the rural communities finish their education in the common chools. They have had little or no opportunity to become acquainted with the science underlying farm work. The young men who expect to become farmers are cordially invited to enter the course in the school of agriculture. The aim is to educate the student toward the farm, and to develop a love for farm life by showing the possibilities of scientific agriculture.

The course extends through three years of six months each and comes in the winter season when the young people can be spared from farm work. For entrance to this course, a student must have finished the 8th grade of the common schools or its equivalent. Those who satisfactorily complete this course will be given diplomas. The general fee of $6.00 is charged. A laboratory fee of $2.00 is required in dairying and chemistry, and $1.00 in biology. The shop deposit is $4.00 per year.

Below is the outline of the course. The names and letters in the parentheses refer to the description of the work which follows the outline.

COURSE IN SCHOOL OF AGRICULTURE

FIRST YEAR

First Semester		Second Semester	
English Composition (Eng. d)	2	English Composition (Eng. d)	3
Botany (Biol. b)	4	Civics	2
Elementary Physics (Physics b)	3	Physics (Physics b)	3
Carpentry (a)	2	Carpentry (a)	2
Nursery Practice (Hort. a)	3	Vegetable Gardening (Hort. b)	3
Animal Types (An. Ind. a)	3	Breeds of Livestock (An. Ind. b)	3
Farm Dairying (Dairy a)	3	Crop Production (Agron. a)	4
Drill	1	Drill	1
	21		21

SECOND YEAR

Rhetoric (Eng. e)	2	Rhetoric (Eng. e)	2
Elem. Chemistry (Chem. a)	3	Elem. Chemistry (Chem. a)	3
Field Crops (Agron. b)	4	Soil Physics (Agron. c)	3
Orcharding (Hort. c)	4	Plant Diseases (Biol. c)	4
Poultry (An. Ind. e)	3	Forge Work (b)	2
Mechanical Drawing (a)	2	Forestry (Hort. d)	3
Forge Work (b)	2	Cheese Making (Dairy b)	3
		Drill	1
Drill	21		21

THIRD YEAR

Literature (Eng. f)	2	Literature (Eng. f)	2
Economic Entomology (Biol. d)	4	Economic Entomology (Biol. d)	4
Principles of Breeding (An. Ind. D)	4	Livestock Feeding (An. Ind. c)	4
Veterinary Science (An. Ind. f)	4	Veterinary Science (An. Ind. f)	4
Landscape Gardening (Hort. e)	3	Milk and Milk Testing (Dairy c)	3
Soil Fertility (Agron. d)	3	Farm Management (Agron. e)	3
Drill	1	Drill	1
	21		21

Intermediate Course

Any student who has finished the school of agriculture course may enter the freshman year of any college course by completing the nine additional units of preparatory work described below. The length of the semester is the same as in the preparatory school—18 weeks.

FIRST YEAR

First Semester		Second Semester	
English (b)	4	English (b)	4
Algebra (a)	4	Algebra (a)	4
History (a) or (b)	4	Geometry (c)	4
German (a)	4	German (a)	4
Physics (a)	4	Physics (a)	4
	20		20

SECOND YEAR

English (c)	4	English (c)	4
Algebra (b)	4	History (a) or (b)	4
Geometry (c)	4	Geometry (d)	4
German (b)	4	German (b)	4
	16		16

EQUIPMENT.

Students in this course have the advantage of a modern dairy in operation, a complete poultry plant with several of the best breeds, modern grain and soil laboratories, model farm buildings and barns, with pure bred live stock, the experiment station farm, green houses and orchards, the large biological, chemical and physical laboratories, and the well equipped wood and iron shops of the engineering department. The methods employed are practical. The instruction is supplemented with practice in the laboratories, the dairy, the orchards, the greenhouse, and with the herds. Visits are also made to other farms and herds in the neighborhood.

AGRONOMY

(a) **Crop Production.**—This course includes a study of the principles underlying, and the factors influencing reproduction, germination, and growth in agricultural plants. II, 4.

(b) **Field Crops.**—A study of the various classes of farm crops, their history, cost of production, consumption, products and by-products. In this course some time is devoted to the judging of grains. I, 4.

(c) **Soil Physics.**—A review of the origin, formation and classification of soils, and a careful study of the conditions influencing the supply of heat and air and moisture as related to growing plants. II, 3.

(d) **Soil Fertility.**—Maintenance of fertiliy, fertilizers and rotation. The influence of manure and the effect of the different crops upon the productive capacity of the soil and upon succeeding crops. I, 3.

(e) **Farm Management.**—This course considers the business side of farming as an industry, also the relation of farming to the other industries. II, 3.

ANIMAL INDUSTRY.

(a) **Animal Types.**—Study of types as related to production and work. Three types of catttle, the dairy, beef and dual purpose; the market classes of horses, the bacon and lard types of hogs, and the mutton and wool types of sheep. I, 3.

(b) **Breeds of Live Stock.**—This is a study of the different breeds of live stock, of the factors that have produced them, and of their adaptability to various conditions and management. II, 3.

(c) **Live Stock Feeding.**—In this course students are taught how to make rations for the different classes of animals and how to feed for best results. He is taught those things that are necessary to make him a successful live stock farmer. Attention is given to preserving, storing and preparing the various fodders, roots and grains produced on the farm.

(d) **Principles of Breeding.**—This course includes a study of the laws of heredity, correlation, reversion, variation, fecundity, methods of breeding, crossbreeding, selection, etc., I, 4.

(e) **Poultry.**—Type and management. Feeding and care of poultry. I, 3.

(f) **Veterinary Science.**—The work in veterinary science consists principally of the study of the different diseases most commonly affecting farm stock, with special reference to diagnosis and treatment. I and II. S.

DAIRYING.

(a) **Farm Dairying.**—The study of dairying as related to the farm; the care of cows; the production of sanitary milk, and the handling of milk for the creamery and city delivery; the construction of milk houses and stables; the advantages of the hand Babcock tester on the farm and the making of the test; a comparison of the gravity and hand separator methods; how to set up and care for the separator so as to get the best results. An opportunity is afforded to study and compare all the leading makes of hand separators. Butter making takes up the practical methods to be employed on the farm for the ripening of the cream, the churning, packing and marketing of butter. I, 3.

(b) **Cheese Making.**—The making of cheddar cheese on the farm. This comprises a study of the care of the milk for cheese making, the process of manufacture, and the curing and marketing. Some work is given also in creamery accounts, with particular reference to the paying for milk or cream at the creamery, and the general handling of the business end of the creamery, to fit young men for co-operative creamery managers and secretaries. II, 3.

(c) **Milk and Milk Ttesting.**—Practical work is given in testing cows as well as milk and all of its products, so that the student may have a clear conception of the relative value of the different breeds of catttle in the production of milk, cream, cheese and butter. This course also comprises a practical study of milk, its production and uses, with especial reference to sanitary methods of handling for city milk trade, creamery and cheese factory. II, 3.

HORTICULTURE.

(a) **Nursery Practice.**—This course deals with the propagation of fruit and ornamental plants for both home and commercial purposes. The work is given in lectures, text book, and practice in the laboratory and greenhouse. I. 3.

(b) **Vegetable Gardening.**—The methods of growing vegetables in the field and under glass, hot bed constructing and management, and the marketing and gathering of vegetables are treated in lectures, text books and practice in the field and greenhouses. II, 3.

(c) **Orcharding.**—The growing, harvesting and marketing of trees and small fruits are studied. Special attention is given to the methods of culture and varieties adapted to Montana conditions. The experiment station orchard offers good opportunities for student work in fruit growing. I, 4.

(d) **Forestry.**—The planting and growing of wind breaks upon farms, the effect of forests upon farm lands, methods of conservative lumbering and preservation of forests, the effect of forests upon water supply, rainfall, temperature, etc., are features of this course. II. 3.

(e) **Landscape Gardening.**—In this course particular attention is given to the study of plans for laying out and planning farm homes. The trees, shrubs, and flowering plants suitable for Montana conditions are studied with methods of propagating and growing them. I, 3.

BIOLOGY

(b) **Botany.**—Three recitations and one laboratory period per week. The elements of botany are taken up, especially with a view to the needs of agricultural students. The classification, structure, physiology and ecology of plants are briefly covered. I, 4.

(c) **Plant Diseases.**—Two recitations and two laboratory periods per week. So far as possible in the limited time available the diseases of the various agricultural and horticultural plants will be studied. This work is conducted upon a scientific basis but at all times the needs of the practical agriculturalist are kept in view. II, 4.

(d) **Entomology.**—Three recitations and one laboratory period per week. After a very brief survey of the animal kingdom, the anatomy, physiology, habits, transformations, and classification of insects are studied, together with the methods for controlling injurious species. This

course is designed, in a comprehensive manner, to prepare the student for defense against the various insect pests of the farm, orchard and garden. I and II, 8.

CHEMISTRY AND PHYSICS.

(a) **Elementary Chemistry.**—Lectures with experimental demonstrations, recitations and laboratory work on the fundamental principles of chemistry, the occurrence, preparations and uses of the common elements and their compounds. The applications of chemistry to agricultural problems will be frequently pointed out. Text book, Remsen's Elements of Chemistry. I and II, 6.

(b) **Elementary Physics.**—Experimental lectures, recitations and assigned problems, three hours per week, on topics selected from mechanics, heat, light, electricity, and magnetism. Emphasis is placed upon those subjects which either have a direct application to argicultural problems or are desirable as a preparation for some subsequent study in the course. The lectures are illustrated with numerous experiments and lantern slides. It will be from properly interpreting the class room exercises and from the work of many practical problems that the student will derive the most benefit. Carhart and Chute's High School Physics will be used as a text book. I and II, 6.

ENGLISH.

(d) **English Composition.**—The first year is devoted largely to practice in the simpler forms of composition. Attention is given to business forms, letter writing, narration, and to the forming of habits of correct speech. I and II, 5.

(e) **Rhetoric.**—During the second year more advanced work is given in composition, with frequent essays, reviews, etc. A few masterpieces are studied as a basis for style of expression. I and II, 4.

(f) **Literature.**—The third year gives a comprehensive study of English and American literature. The object is to develop an appreciation for the works of standard authors and a taste for the great masterpieces of the language. I and II, 4.

MECHANIC ARTS

(a) **Carpentry.**—The use and care of carpenter's tools. A series of exercises in joinery, followed by practice in framing, rafter and stair cutting, and such other plain carpentry as will be of utility on the farm. I and II, 4.

(b) **Forge Work.**—The care and manipulation of the fire, iron forging, including the operations of drawing, upsetting, pointing, bending, welding, calculation of stock. Implement repairs, plow pointing, manufacture of chains, hooks, clevises, clips, etc. Steel forging, hardening and tempering cold chisels, hardies, punches, cold cutters, etc. I and II, 4.

School of Pharmacy

PROF. MOLLETT

This school offers a four years course in pharmacy, leading to the degree of pharmaceutical chemist (Ph. C.).

The object is to provide the people of the state with reliable and competent pharmacists.

This course requires two full academic years for completion and provides the foundation in materia medica, pharmacy and analytical chemistry as applied to the drug business, and required for pharmaceutical manufacture and dispensing; and also thoroughly qualifies the graduate to meet the examination given in any state for the position of registered pharmacist.

Candidates for admission to the course must be at least eighteen years of age and may be admitted (a) by presenting a certificate from an accredited high school, showing that not less than one year of work has been completed; (b) by examination on an equivalent amount of work in subjects designated by the college; (c) by faculty approval of grades from other than accredited high schools.

While it is not compulsory, it is advised that students have one or two years practical training in a drug store.

In addition to the annual tuition fee of $12.00, deposits are required as follows: Pharmacy (3), $10.00; (4), $2.00; (5), $2.00; (6), $2.00; (7), $6.00; (10), $4.00; (11), $6.00.

The students have access to such of the chemical and botanical laboratories as the work calls for, as well as those of pharmacy and materia medica. Those laboratories contain all the modern equipment necessary for the proper instruction of the students. Free access is also granted to the standard reference books in the several branches of science, and the magazines and journals of chemistry and pharmacy.

Lectures will be given throughout the course on chosen subjects, by those who have gained prominence in pharmaceutical pursuits, and in the sciences closely related to pharmacy. All pharmacy students will be required to attend these lectures, for which a credit of one hour is given for the semester.

All regular students will be required to keep notes on the work done, and present the same for examination and rating. Oral and written quizzes will be given during each course, and a final written examination at the close of the senior year covering the entire course of instruction in pharmacy. This examination will resemble in every respect those given by the state board of pharmacy.

PHARMACY.

FIRST YEAR

First Semester		Second Semester	
Gen. Inorg. Chemistry (Chem. 1)	4	Gen. Inorg. Chemistry (Chem. 1)	4
Gen. Botany (Biol. 9)	3	Physiology (Biol. 3)	4
Introductory Pharmacy (1)	5	Official Pharmacy (2)	4
Pharmacy Latin	4	Pharmacy Laboratory (3)	2
		Pharmacognosy (4)	4
	18		18

SECOND YEAR

Organic Chemistry (Chem. 5)	3	Micros. Study of Po. Drugs	2
Qualitative Analysis (Chem. 2)	4	Organic Chemistry (Chem. 5)	3
Inorganic Pharmacy (6)	4	Quantitative Analysis (Chem. 3)	4
Pharmaceut. Testing and Drug Assaying (7)	3	Materia Medica and Therapeutics (8)	4
Bacteriology (Biol. 12)	2	Dispensing (9)	4
Lectures	2	Toxicology (10)	1
Mineralogy (Chem. 11)	1	Physiological Chemistry (11)	2
		Thesis	2
	17		19

PHARMACY.

(1) **Introductory Pharmacy.**—The course consists of a thorough study of the theory of pharmacy, the authoritative guides and the use of pharmaceutical apparatus; a systematic study of the subjects of weight, measure, specific gravity, specific volume, percentage solution, and all the common processes in pharmacy, and the principles of pharmaceutical arithmetic involved, together with many operations of the dispensing counter. The official classification of galenical preparations is also considered. Lectures and recitations, I, 4.

(2) **Official Pharmacy.**—A continuation of course 1, and must be preceded by it, consisting of a thoroughly scientific study of the preparations in the United States Pharmacopoeia and National Formulary. The galenicals are carefully considered with regard to classification, technical nomenclature, mode of preparation, preservation, percentage composition and dose of each individual preparation. Texts, U. S. Pharmacopoeia, eighth revision, and National Formulary, third edition. Lectures and recitations. II, 4.

(3) **Pharmacy Laboratory.**—A practical laboratory course in which many of the important, and difficult medicinal preparations of the U. S. Pharmacopoeia are manufactured by each student, especially the typical representatives of each class of galenicals, such as waters, tinctures, fluid extracts, spirits, elixirs, pills, suppositories, ointments, etc. Neatness, accuracy, quantity and quality of work done will determine the student's standing. II, 2.

(4) **Pharmacognosy.**—A study of the natural history and important features of crude drugs; the means of identification and selection; constituents, action, dose, and official preparations. The official organic drugs and some of the commonly used non-official ones will be studied in the following order: (a) Plant drugs—Roots, rhizomes, tubers, bulbs, leaves and leaflets, herbs and flowers, fruits and seeds, gums, resins, balsams, etc. (b) Animal drugs—The student has actual access to the typical specimens in the materia medica laboratory. Lectures and laboratory exercises. II, 4.

(5) **Microscopical Study of Powdered Drugs.**—This course consists of the study of powdered vegetable drugs and their common adulterants by the aid of the microscope. By the preparation of slides and drawings the student learns the most important characteristics of the different drugs most commonly adulterated and their common adulterants, and is thus enabled to determine questions of identity and purity. Lectures and laboratory exercises. II, 2.

(6) **Inorganic Pharmacy.**—Inorganic salts, acids and their official preparations, source, manufacture, means of identity, strength, solubility, action, use and dose are considered. The students have access to the U. S. P. specimens in the materia medica laboratory. Must be preceded by chemistry 1 and 2. Lectures, recitations and laboratory work. I, 4.

(7) **Pharmaceutical Testing and Drug Assaying.**—This is largely a laboratory course; practice in testing the purity and strength of the inorganic medicines, chemicals, organic drugs, and preparations, according to the methods of the U. S. Pharmacopoeia. Lectures, recitations and laboratory work. I, 3.

(8) **Materia Medica and Therapeutics.**—Lectures and recitations on the physical, physiological and chemical properties of the materials used for curative and remedial purposes. Special attention is given to the active constituents of crude drugs, their action on the human body, therapeutic classification and application to the treatment of diseases, together with dosage and methods of dispensing. Lectures and recitations. II, 4.

(9) **Dispensing.**—A technical study of all phases of the prescription, and practical work in the art of compounding and dispensing. Lectures and laboratory exercises. II, 1.

(10) **Toxicology.**—Lectures and recitations, covering the effects of poisons on the human body, methods of detection, antidotes and toxic posology, and such knowledge of the subject as is indispensable in the safe practice of pharmacy. II, 1.

(11) **Physiological Chemistry.**—A study of the fundamental principles and facts of carbohydrates, proteins, normal and abnormal products of animal life. The analysis of the various secretions, e. g., saliva, gastric and pancreatic juices. Urinalysis, chemically and microscopically. Lectures and laboratory work. II, 2.

(12) **Thesis.**—All students in pharmacy are required to prepare a graduating thesis upon some subject relating to the pharmacy profession. The outline of this thesis should be presented for approval at the beginning of the senior year, or, in the two year course, at the beginning of the second semester. II, 2.

One Year Course in Household Economy

The one year course is intended for those who wish systematic work in household economy and who cannot take the time for a four year course. The work is necessarily much more elementary than in the longer course, and no degree is given. A diploma, crediting the student with one year's work, is given upon the satisfactory completion of the course.

First Semester		Second Semester	
English Composition (a)	4	English Composition (a)	4
Sanitation (c)	2	Sanitation (c)	2
Sewing (e)	5	Sewing (e)	5
Cooking (e)	5	Cooking (e)	5
Household Economy (f)	1	Household Economy (f)	1
Music or Art	2	Music or Dairying	2
	19		19

Note: See preparatory school for sub-courses, English (a) and Sanitation (c). Those who have credit for English (a) will be allowed to elect some other subject.

(e) **Cooking.**—This work is both theoretical and practical. During the second semester each student gives one demonstration. Much attention is given to serving meals. For final examination each student prepares two three-course luncheons. I and II, 10.

(f) **Household Economy.**—House construction and material furnishings, management, and care of all parts of the house. The text book used is Miss Parloa's Home Economics. Lectures on marketing are also given, including such subjects as methods of buying, home and foreign products, care of supplies, household arts, as cleaning, sweeping, cleaning paints, windows and metals, care of dining room, duties of hostess and waitress, table etiquette, planning bills of fare, and calculation of cost of various dishes made in the cooking class. I and II, 2.

(e) **Sewing.**—In the first semester drills on making different stitches and seams are given. Drafting and making underwear. In the second semester, drafting, cutting and making plain waists and skirts. Two shirt waists, a wool dress and the graduating dress must be made. I, II, 10.

(c) **Dairying.**—The elaboration, composition, properties, and fermentations of milk. The methods used in testing, buying, and preserving milk for food, or for manufacturing purposes. The manufacturing of butter and cheese, with explanations of the defects in much of the butter and cheese used for domestic purposes, and how these defects may be de-

tected and overcome. Students who desire may take practical work in the college dairy along with the special dairy students, in both butter and cheese making. II, 2.

(c) **Art.**—Freehand drawing from geometric solids and casts. Study of light and shade. Clay modeling. Object drawing. Study of plant forms, with suggestions for their application to design. Memory and time drawing. Blackboard work frequently. I, 2.

Winter Dairy Courses

There are a great many people in the state who cannot leave their homes long enough to take any of the regular courses offered in the college. To meet the demands for information about dairying and dairy farming, a one week special course will be offered to farmers, farmers' wives and daughters. This course will be largely practical, and will deal with the care of milk, cream ripening, churning and cheese making, as well as judging, feeding and management of dairy cows, the most profitable disposal of skim milk, whey, etc.

Both the men and women will take the dairy work and while the men are taking stock judging, etc., the domestic science department will give a course for the women in cooking and sewing. Each woman who comes may have a pattern of a dress cut for herself. One afternoon will be spent on a shirt waist and another on a skirt pattern.

FARM DAIRYING AND DOMESTIC SCIENCE COURSE.

Jan. 31 to Feb. 5th, 1910.

Dairying (for men and women).....15 lectures
Live Stock (for men) 15 lectures
Domestic Science (for women 15 lectures

For those who wish to prepare for regular creamery work, the following course is offered:

FOUR WEEKS' CREAMERY COURSE

Beginning just after the short dairy course for farmers there will be a four weeks creamery course, running from February 7 to March 5. There is a growing demand for butter and cheese makers in the state, and this course has been designed to fit young men to fill these positions. The course will last four weeks, and all of the student's time will be spent in the college creamery doing the actual work on the dairy floor. By this means he will be brought into touch with the problems of the average factory. In addition to the creamery practice, two lectures will be given each day, dealing with subjects which cannot be taken up in practice on account of the short time allowed for this work. On the last day a final examination will be held. By this means, as well as by the students' work in the creamery, it will be possible to judge of their ability to fill available positions.

Alumni

Allen, Elbert, B. S., 1903; Attorney at Law, Livingston, Mont.

Alward, Mary L.,B. S.,1908; Teacher in Pony Public Schools, Pony, Mont.

Baker, Harold E., B. E. E., 1907; Operator or Assistant Engineer, Butte.

Benton, Ralph, B. S., 1906; Instructor in Entomology, College of Agriculculture, University of California, and Assistant Entomologist in charge of Apiculture, California Experiment Station, Berkeley, California.

Blankenship ,Hon. E. V., B. S., 1897; Yellowstone Park Transportation, Farming and Stock Raising, Bozeman, Mont.

Bole, William S., B. S., 1906; Medical Student at Johns Hopkins University, Baltimore, Md.

Breneman, Annie T., B. S. 1907; Teacher in Eighth Grade, Bozeman, Mont.

Brown, Edith E., B. S., 1904; Teacher of Pianoforte and Theory, Regina, Sask., Canada.

Burke, Edmund, B. S., 1907; Chemist and Meteorologist of the Montana Agricultural Experiment Station, Bozeman, Mont.

Bull, Frieda M., B. S., 1907; Assistant in Mathematics and Physics, Montana Agricultural College, Bozeman, Mont.

Caldwell, T. O., B. A. C., 1899; One of four leasers of the Gold Reef Mine, Gilt Edge, Mont.

Chaffee, C. Sarah, B. S., 1906; Teacher of Mathematics in Pocatello High School, Pocatello, Idaho.

Cockrell, Irvin, B. A. C., 1900; Student in Osteopthy, Kirksville, Mo.

Collins, W. E., B. S., 1902; Trust Officer of State Savings Bank, Butte, Montana.

Cooke, Amy, B. S., 1908; Science Teacher in Custer County High School, Miles City, Mont.

Cowan, Lewis. B. C. E., 1904; Civil Engineer, Denver, Colo.

DeMuth, Maude S., B. S., 1907; Bozeman, Mont.

Driscoll, William J., B. S., 1908; Lawrence, Mass.

Fisher, Chas. M., B. S., 1908; Graduate Student at Cornell University, Ithaca, N. Y.

Flager, Harold James, B. E. E., 1907; Graduate Student at Cornell University, Ithaca, N. Y.

Flager, Howard A., B. E. E., 1906; Clerk in Mercantile Establishment, Red Lodge, Mont.

Flaherty, Charles David, B. C. E., 1904; Civil Engineer, Firm of Sackett and Flaherty, Livingston, Mont.

Foster, Florence, B. S., 1896; Associate Professor of Household Economics, Agricultural College of New Mexico.

Freeman, Beatrice, B. S., 1900; Mrs. Thos. S. Davis, Columbus, Mont.

Freeman, W. B., B. C. E., 1903; District Engineer U. S. Geological Survey in Charge Denver District of Water Resources Branch, Denver, Colo.

Gardiner, Henry C., B. S. A., 1903; Veterinarian and Proprietor of the Gallatin Veterinary Hospital, Bozeman, Mont.

Griffith, Warren J., B. E. E., 1907; Operator for Madison Power Co., Norris, Montana.

Ham, Frank W., B. S., 1903; M. S., 1905; Instructor in Physics, Montana Agricultural College, Bozeman, Mont.

Hartman, Lois Kathryn, B. S., 1907; Instructor in Domestic Science Training School of University of Utah, Salt Lake City, Utah.

Hartman, Will S., B. S., 1908; Assistant Hydrographer, Isthmian Canal Commission, Culebra, Canal Zone, Central America.

Hawkins, P. H., M. S., 1903;Banker, Absaroka, Mont.

Hutton, Fred, B. E. E., 1902; Deceased.

Jones, Burle J., B. S., 1904; Manager of Orangewood Nursery Co., Phoenix, Arizona.

Jones, Wyatt Wagner, B. S., 1901; M. S., 1902; Principal Teton County High School, Choteau, Mont.

King, Lowell R., B. S., 1904; Civil Engineer, B. & B. Dept., C. M. & P. S. Ry., Whitehall, Mont.

Kinney, Edward D., B. C. E., 1907; Transitman Northern Pacific R. R., Moclips, Wash.

Kirk, Mary E., B. S., 1906; Bozeman, Mont.

Koch, Elers, B. S., 1901; Forest Supervisor, U. S. Forest Service, Missoula, Mont.

Lamme, Maurice A., B. S., 1903;Tutor in Mineralogy, Columbia University, New York City.

Lewis, Edna, B. S., 1903; Instructor in Mathematics, Gallatin County High School and Member County Board of Examiners, Bozeman, Montana.

Locke, Jerome George, B. C. E., 1908; Member of Engineering and Real Estate Firm of Locke and Dier, Bozeman, Montana.

Lorentz, Floyd S., B. E. E., 1907; Operator at the Anaconda Sub-station of the United Missouri River Power Co., Anaconda, Mont.

Maynard, Edna, B. S., 1900; M. S., 1903; Mrs. G. T. Morris, Salt Lake City, Utah.

Monforton, Zoe, B. S., 1901; Mrs. Dr. H. C. Patterson, Bozeman, Mont.

Moore, Ellie J., B. S., 1901; Insurance Solicitor, Spokane, Wash.

Morgan, O. P., B. S., 1896; Farmer, Sedan, Mont.

Morris, Garfield T., B. C. E., 1903; Assistant Engineer O S. L. R. R., Salt Lake City, Utah.

Mountjoy, Agnes, B S., 1907; Teacher in Public School, Whitehall, Mont.

Mountjoy, Irvine, B. S., 1908; Student Apprentice of General Electric Co., Pittsfield, Mass.

Nash, Lewis T., B. S., 1904; In Grocery Business, Bozeman, Mont.

Osborn, Belle, B. S., 1907; Teacher of Domestic Science, Botany and Zoology in Beaverhead County High School, Dillon, Mont.

Pease, Jay L., B. C. E., 1907; Montana Representative of the Portland and Seattle Construction Co., Bozeman, Mont.

Penwell, Clyde C., B. S., 1906; Graduate Student, Cornell University, Ithaca, New York.

Penwell, C W., B. E. E., 1907; Electrical Engineer, Great Falls, Mont.

Potter, Ermine L., B. S., 1906; Instructor in Animal Husbandry, Oregon Agricultural College, Corvallis, Oregon.

Quaw, Lucile, B. S., 1903; Bozeman, Mont.

Quaw, Mignon, B. S., 1902; Clerk, Bozeman, Mont.

Quaw, Thos. B., B. S., 1907; Clerk in Grocery Store, Bozeman, Mont.

Reese, Herbert J., B. S., 1904; Central and Umpire Chemist, Denver, Colo.

Robinson, J. W., B. S., 1908; Assistant in Chemistry, Montana Agricultural College, Bozeman, Mont.

Sackettt, Chas. ., B. C. E., 1904; C. E., 1907; City Engineer, County Surveyor of Park County, U. S. Mineral Surveyor, Livingston, Montana.

Sales, Reno H., B. S., 1898; Geologist, Amalgamated Copper Co., Butte, Montana.

Schabarker, W. W., B. M. E., 1902; Machinist for Milwaukee R. R., 3020 Park Hill Ave., Milwaukee, Wis.

Schmidt, F. W., B. S., 1903; Superintendent of a Cyanide and Amalgamation Plant, Brazil, South America

Shaw, W. T., B. S., 1896.

Sloan, W. F., B. E. E., 1903; Electrical Inspector for Railroad Commission, and W. S. B. A. of Wisconsin, Madison, Wis.

Sloan, J H., B. C. E., 1903; Civil Engineer, Bozeman, Mont.

Spragg, Frank A., B. S. A., 1902; Plant Breeder of Farm Crops for the Michigan Experiment Station, Lansing, Mich.

Stafford, Lucy, B. S., 1896; Mrs. William Otis Peck, Pony, Mont.

Tavenner, Frank C., B. C. E., 1903; Instructor in Machine Shops and Mechanical Drawing, California Polytechnic School, San Luis Obispo, Calif.

Thompson, Homer C., B. S., 1902; Superintendent of Public Schools of Choteau, Teton County, Choteau, and Three Forks, Mont.

Thorpe, Mabel A., B. S., 1907; Secretary in Central Y. W. C. A., Toledo, Ohio.

Thorpe, Elizabeth, B. S., 1907; Teacher in Hungerford Academy, Springville, Utah

Tracy, Edna, B. S., 1908; Teacher in High School, Pony, Mont.

Williams, Frank B., B. M. E., 1899; Jeweler, Firm of Williams Bros., Boulder, Montana.

Williams, Lee, B. E. E., 1902; County Surveyor, Powell County and City Engineer Deer Lodge, Mont.

Widener, Carl C., B. S., 1908; Civil Engineer, City Engineer's Office, Bozeman, Montana.

SCHOOL OF MUSIC GRADUATES.

Alward, Coda, Piano, 1908, Teacher and Student Bozeman
Brown, Edith, Piano, 1906, Teacher Regina, Canada
Featherstone, Ellis, Piano, 1907, Student Syracuse, N. Y.
Freeman, Lorraine, Piano, 1906, Student.....Germany
Griffin, Grace, Piano, 1907, Mrs. W. C. Blyth.....Whittier, California
Hartman, Flora, Piano, 1907, Student Syracuse, N. Y.
Lovelace, Amy, Vocal, 1908, Student New York City
Piedalue, Alice, Piano, 1908, Teacher Bozeman
Stanton, Grace, Piano, 1901, Mrs. W. B. Walker.....Glendive
Waters, Mary, Piano, 1902, Mrs. H. L. Houston, Teacher.....Bozeman
Widener, Carl, Vocal, 1908, Civil Engineer... Bozeman
Widener, Ethel, Piano, 1907, Teacher, Mont. Coll..... Deer Lodge

DEGREES GRANTED, JUNE 1909.

Alward, Jamie L.....Bachelor of Science in Chemistry.....Bozeman
Cooke, Amy M.....Bachelor of Science in Math.-Physics..Bozeman
Driscoll, Wm. J.....Bachelor of Civil Engineering ...Lawrence, Mass.
Fisher, Chas. M.....Bachelor of Electrical Engineering... ..Bozeman
Hartman, Will S.....Bachelor of Civil Engineering Bozeman
Locke, Jerome G.....Bachelor of Civil Engineering Livingston
Mountjoy, Irvine Bachelor of Electrical Engineering .Twin Bridges
Robinson, J. Wilbur....Bachelor of Science in Chemistry Bozeman
Tracy, Edna B.....Bachelor of Science in Chemistry Bozeman
Widener, Carl C.....Bachelor of Civil Engineering Bozeman
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NAMES OF STUDENTS, 1908—1909.

POST GRADUATES

Bull, Frieda, B. S. Mathematics Bozeman
Hawkins, P. H., M. S.....Biology Columbus
Mollet, Chas. E. F., Ph. C.....Biology Bozeman
Quaw, Lucile, B. S.....Home Science Bozeman
Robinson, J. Wilbur, B. S.....Chemistry Bozeman
Schoppe, Wm. F., B. S.....Biology Bozeman
—6—

SENIORS

Brewer, Lucile Home Science... Gordon, Neb.
Bull, Edna Home Science Bozeman
Butter, Donald Electrical Engineering....Culbertson
Edwards, Timothy F. Civil Engineering Frazee, Minn.



BOYS' BASKET BALL TEAM.

GIRLS' BASKET BALL TEAM.



ATHLETIC TEAMS.

Gottschalck, Carl	Chemistry	Bozeman
Henderson, Lyle C.	Electrical Engineering	Livingston
Hind, Bert S.	Electrical Engineering	Kendall
James, John S.	Civil Engineering	Cascade
King, Ruby E.	Home Science	Bozeman
Kircher, W. Guy	Electrical Engineering	Townsend
Morris, Elwood	Agriculture	Virginia City
Noble, Erma	Mathematics-Physics	Bozeman
Peters, Orville S.	Electrical Engineering	Clinton, Wis.
Peterson, James A.	History-Literature	Absaroka
Spain, W. Whitfield	Agriculture	Bozeman
Vreeland, Edna	Home Science	Bozeman
Wilson, Elva A.	History-Literature	Bozeman

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JUNIORS

Annin, James	Agriculture	Columbus
Barnard, Robert B.	Electrical Engineering	Great Falls
Bell, James C.	Agriculture	Gilt Edge
Booker, Clinton T.	Electrical Engineering	Helena
Brown, Archie S.	Electrical Engineering	Great Falls
Carmichael, Effie M.	Home Science	Bozeman
Cooley, Ralph	Agriculture	Manhattan, Kas.
Davidson, Mary E.	Home Science	Bozeman
De Muth, David R.	Civil Engineering	Peru, Ind.
Fisher, Helen	Home Science	Bozeman
Flager, Ruth	Home Science	Red Lodge
Fox, Hazel	Math.-Physics	Bozeman
Froebe, Frank J.	Civil Engineering	Absarokee
Gray, Wright	Agriculture	Bozeman
Hansen, Gilbert E.	Agriculture	Bozeman
Hartman, June	Math.-Physics	Bozeman
Henderson, Chas. F.	Electrical Engineering	Hall
Hogan, Geo. R.	Agriculture	Musselshell
Homann, Fred R.	Mechancal Engineering	Bozeman
Jacobs, Lillian	History-Literature	Columbus
Keene, Franklin A.	Civil Engineering	Townsend
Kennedy, Cyril C.	Electrical Engineering	Glendive
Kimpton, Addie	Home Science	Radersburg
King, Willard V.	Biology	Whitehall
Kremer, Wm. J.	Civil Engineering	Mt. Carroll, Ill.
Livingston, Mildred B.	Home Science	Bozeman
Livingston, Walter T.	Civil Engineering	Bozeman
Luther, J. Glenn	Electrical Engineering	Choteau
Pool, Louis K.	Civil Engineering	Townsend
Quaw, Eugene	History-Literature	Bozeman
Smith, Walter A.	Agriculture	Fridley
Sloan, Wm. Glenn	Civil Engineering	Helena
Wade, Arthur M.	Electrical Engineering, Hopkins, Minn.	
Walchli, Fred E.	Mechanical Engineering	Kalispell
Wylie, Mary G.	Home Science	Bozeman

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SOPHOMORES

Anderson, Lee B.	Electrical Engineering	Bozeman
Allen, Edgar W.	Pharmacy	Joliet

Baker, Florence	History-Literature	Bozeman
Bancroft, Raymond	Agriculture	Oakley, Kas.
Breneman, Helen	Home Science	Bozeman
Buell, Vera	History-Literature	Bozeman
Cameron, Gertrude	Math.-Physics	Bozeman
Carr, Irene	Home Science	Bozeman
Clark, Ben A.	Civil Engineering	Hunter's Hot Spgs.
Clark, Ida Grace	Home Science	Belgrade
Cooke, Ruth	History-Literature	Bozeman
Cox, Harvey	Pharmacy	Bozeman
Dahling, Hugo J.	Civil Engineering	Bozeman
Edsall, William S.	Electrical Engineering	Bozeman
Ellis, Edward M.	Electrical Engineering	Bozeman
Fiske, Gretchen	Home Science	Helena
Higgins, Lucile	Math.-Physics	Townsend
Haines, Will T.	Electrical Engineering	Sheridan
Hamilton, Everett A.	Electrical Engineering	Belgrade
Hinman, Ruth	History-Literature	Bozeman
King, Glen	Mechanical Engineering	Ft. Benton
Kirk, Grace	Home Science	Salesville
Metheny, Blanche	Home Science	Bozeman
Mitchell, Paul	Pharmacy	Bozeman
Morris, Ernest R.	Civil Engineering	Virginia City
Norton, Thos. M.	Agriculture	Hamilton
Philbott, June	Math.-Physics	Bozeman
Pierlalue, Irene	Home Science	Bozeman
Peck, Harry	Electrical Engineering	Garneill
Sheriff, Court	Agriculture	Helena
Snider, Leta	Math.-Physics	Bozeman
Spain, Marvin	Agriculture	Bozeman
Tremper, Wm. J.	Civil Engineering	Helena
Widener, Faye	Civil Engineering	Bozeman
Williams, Elmer J.	Chemistry	Great Falls
Williams, Roy B.	Civil Engineering	Bozeman
Williams, Sidney A.	Electrical Engineering	Boulder
Wilcox, Guy M.	Electrical Engineering	Dupuyer
Willson, Herman	Agriculture	Bozeman
Wilson, Harmon	Civil Engineering	Bozeman
Wolpert, Harold E.	Electrical Engineering	Boulder

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FRESHMEN

Alexander, Grayce	Home Science	Bozeman
Baker, Lulu	History-Literature	Bozeman
Bancroft, Ross L.	Agriculture	Oakley, Kas.
Buford, Walter W.	Civil Engineering	Virginia City
Clark, Olive	Home Science	Hunters Hot Springs
Conard, Blanche	Pharmacy	Bozeman
Cook, Fred	Mechanical Engineering	Choteau
Cook, George H.	Agriculture	Como
Couper, Albert C.	Chemistry	Northfield, Minn.
Daley, Freeman A.	Civil Engineering	Choteau
Dick, Edwin L.	Electrical Engineering	Rimini
Donaldson, Noble C.	Agriculture	Helena
Draper, Chas. H.	History-Literature	Red Lodge

Drinville, James	Pharmacy	Kendall
Dusenbery, Vincent F.	History-Literature	Bozeman
Dusebery, Inez M.	History-Literature	Bozeman
Fisher, Wallace	Electrical Engineering	Bozeman
Franzman, Gladys	Home Science	Phillipsburg
Frischke, Frieda	Home Science	Columbus
Gatton, Florence	Home Science	Bozeman
Green, Jesse R.	Mechanical Engineering	Manhattan
Hagerman, Edna	Home Science	Great Falls
Hansen, Charles L.	Agriculture	Dillon
Hodgkiss, J. Edward	History-Literature	Dillon
Hoepfner, Harold	Electrical Engineering	Helmville
Holzemer, John	Electrical Engineering	Lewistown
Hutton, Lontie	Electrical Engineering	Jeffers
Jones, Kyle	History-Literature	Choteau
Johnson, D. Dailey	Civil Engineering	Helena
Kirk, Cassius L.	Civil Engineering	Salesville
King, John A.	Pharmacy	Ft. Benton
Koch, Lewis B.	Civil Eng.	Salt Lake City, Utah.
Lannin, Earl A.	Electrical Engineering	Butte
Lewis, Clara	Biology	Clara
Lewis, Max C.	Civil Engineering	Dewey
May, Clare D.	Pharmacy	Stevensville
McCraw, John L.	Civil Engineering	Bozeman
McIntosh, Ruth	Home Science	Olney, Colo.
Millegan, Guy J.	Agriculture	Great Falls
Mitchell, Agnes	Home Science	Bozeman
Moore, James	Mechanical Engineering	Hamilton
Morgan, Geo. W.	Agriculture	Bozeman
Morgan, Joseph D.	Chemistry	Bozeman
Paul, Will H.	Electrical Engineering	Butte
Piedalue, Laura	Home Science	Bozeman
Perrine, Carlotta	Home Science	Utica
Phillips, Bessie	Home Science	Utica
Phillips, Leslie R.	History-Literature	Stevensville
Pound, Samuel R.	Civil Engineering	Big Timber
Sackett, Nathalie	Civil Engineering	Bozeman
Shellenberger, Rita	Home Science	Willow Creek
Scharf, Hans	Forestry	Basle, Switzerland
Shovell, Wm. L.	Agriculture	Hamilton
Smith, Chas. M.	Electrical Engineering	Lewistown
Smith, Eunice E.	History-Literature	Lewistown
Smith, Maud	Home Science	Belgrade
Slayton, Dan E.	Mechanical Engineering	Lavina
Stanley, Howard	Electrical Engineering	Great Falls
Taylor, John E.	Agriculture	Chinook
Temple, Leslie	Electrical Engineering	Radersburg
Valentine, Chas. P.	Pharmacy	Helena
Wilson, Florence	History-Literature	Columbus
Young, Earl	Pharmacy	Belt

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IRREGULAR

Benge, Faith	Home Science	Winterset, Iowa
Bond, LeRoy M.	Agriculture	St. Paul, Minn.

Gore, James H. Agriculture Hamilton
Joslyn, Mignon Home Science Deer Lodge
LeFevre, Wm. T. Biology Kalispell
Metcalf, Mollie Home Science Phillipsburg
Nickel, Adaline Art Darbee
Phillips, Elizabeth Home Science Lewistown
Reichart, Mrs. A. G. Home Science Bozeman
Soper, Charles H. Agriculture Bozeman
White, Etta... Home Science Ft. Shaw
Wilson, N. W. Pharmacy Bozeman

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SCHOOL OF ART

Auerbach, William Havre
Bennett, Frances Livingston
Bromley, Merle, ... Bozeman
Bromley, Edna Bozeman
Hendrie, Mabel Lewistown
King, Gladys... Bozeman
Kountz, Mamie Bozeman
Lansing, Gladys L..... .. Bozeman
Olson, Frank Livingston

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THIRD PREPARATORY

Anderson, Ruth Bozeman
Bancroft, Clark Bozeman
Berg, Ida Lennep
Bole, Margaret Bozeman
Border, Edna Bozeman
Brown, Everett Bozeman
Brook, Thomas Bozeman
Buford, Luther Virginia City
Cox, Foster Pony
Crouch, Leslie Bozeman
Esmay, Julien Bozeman
Griffith, Gilbert Gebo
Hartman, Brooke Bozeman
Hartman, Ruth Bozeman
Hauswirth, Herbert Anaconda
Hogan, Norman Musselshell
Holderby, Mattie Bozeman
Jeffries, Winifred Belt
Jackson, Ernest Harrison
Kennedy, Everett Harlem
Kirk, Howard Bozeman
Kountz, Frank Bozeman
Kruse, Jacob Bozeman
Labre, Tilford Harlowtown
Leinard, F. B. Bryan, Ohio
Lewis, Arlene Dewey
Lewis, Albert Clara
Love, Raymond Columbia
Martin, Claude... Stockett
McLeod, Elmer Salesville
McMahon, Blanche Big Elk
McGuire, Frank Shannon
Nordquist, Joseph Bozeman
Phillips, Robt. Lewistown
Rich, Eliza...Hunter's Hot Springs
Roades, Eva Bozeman
Spain, Roy Bozeman
Spaulding, George Salesville
Slayton, Lydia Lavina
Steeman, Elmer Stevensville
Snell, Helen Straw
Talmage, Earl Red Lodge
Tannatt, Hazel Bozeman
Uhl, Charles Livingston
Van Asin, Roxine Bozeman
Van Camp, Ethel Two Dot
Walker, Arthur Ft. Benton
Willson, Glenn Bozeman
Winter, Nelia Bozeman

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SECOND PREPARATORY

Allard, Peter Laurel
Bancroft, Alma Bozeman
Baker, Raymond Bozeman
Beley, Fred Livingston
Bradley, Valeria Bozeman
Breneman, Edith Bozeman
Chesnut, Floyd... Clancy
Coombs, Edward.. Laurel
Duffield, Wm. Joliet
Elliot, Frances Malta
Elliott, Willis Great Falls
Earhart, Charlotte Bozeman

Ferguson, Stella Bozeman
Hall, Earl Bozeman
Hardgrove, Everett Stearns
Kammerer, Harry Virginia City
Kirby, Noah... Gebo, Wyo.
Martin, Harvey.Hunter's Hot Spgs.
Moore, Inez.... Bozeman
Phillips, Julia.. Lewistown
Phillips, Mary Lewistown
Pope, Harold Big Timber
Piper, Lawrence Livingston
Roberson, Bess Sixteen
Smith, Ralph Belgrade
Shriver, Frank Jeffers
Vreeland, Marjory Bozeman
Walker, Maryette Ft. Benton
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FIRST PREPARATORY

Bower, Edith Jeffers
Brook, Gladys Bozeman
Cox, Percy Birney
Crouse, Lester Belgrade
Etan, Emil Belgrade
Fox, Leroy Clyde Park
Glover, Will Chimney Rock
Green, Dorothy Belgrade
Hoy, Charles Raymond
Higgins, Patti Toston
Keller, Louis Lewistown
Keller, Walter Lewistown
Keene, Jesse Canton
Keene, Virginia Canton
Kammerer, Wm. Virginia City
Lasher, Percy Ashtabula, Ohio
Lorentz, Noyes Toston
McKee, Zora Jeffers
Mongrain, Chas. Toston
Murray, Richard Chesnut
Potter, Glenn Livingston
Sexton, Earl... Belgrade
Stuart, Albert Belgrade
Smith, Fred Bozeman
Tackinaka, George Helena
Tucker, Walter Flesher
Urbach, Albert Livingston
Wendel, Edward Helena
Wilkes, Chas. ..Hunter's Hot Spgs.
White, Kittie Bozeman
Woodward, Edward.. Divide
—31—

IRREGULARS

Arema, Edward Bozeman
Blessing, John...Barnesville, Minn.
Chadbourne, Clarence Livingston
Distad, John Bozeman
Fransham, Chas. Bozeman
Haaland, Jasper, Hanley Falls, Minn.
McKnight, W. A. Red Rock
Mercer, Clifford Twin Bridges
Mercer, Geo... Twin Bridges
Ward, Leroy Bozeman
Willson, Walter Bozeman
Williams, Warren E.... Radersburg
—12—

SCHOOL OF AGRICULTURE

THIRD YEAR

Calk, James C..... Mt. Sterling, Ky.
Keene, Guy... Townsend
—2—

SECOND YEAR

Blessing, Adolph..Barnesville, Minn.
Distad, John Bozeman
*English, Herbert Big Sandy
Jackson, Joel Harrison
Schultz, E. W. ...Brownsville, Wis.
Taylor, Fred B.... Bozeman
—6—

FIRST YEAR.

Allison, Jay A. Phillipsburg
Bailey, Joseph M. ...Spencer, Ia.
Calk, Thomas ...Mt. Sterling, Ky.
Dodgson, Isaac Melrose
Harvey, Hubert W.....Melrose
Haynes, John Clancy
Huth, Otto A..... Huntley
Jones, Ralph Bozeman

*Deceased

Lindsey, Leslie T. Kendall
McKenzie, Ian D. Miles City
Moger, Fred. Bozeman
Peck, John W. Garneill
Seidenstricker, John ..Twin Bridges
Smith, Rollin A. Bozeman
Tate, J. Herman Missoula
VanVliet, Herbert Stevensville
Walker, Martin Bozeman

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HOME SCIENCE—1 YEAR COURSE

Berg, Cora Lennup
Bish, May Bowbells, N. D.
Booth, Blanche Billings
Cline, Muriel Chesnut
Corrie, Eva M. Bozeman
Distad, Amanda Bozeman
Holland, Ragna Bozeman
Jackson, Grace Harrison
Lindsey, Stella Kendall
McLeod, Bertha. Bozeman
McLeod, Frances Bozeman
Matthews, Leona Bozeman
Matthews, Leonora Bozeman
Naderman, Kate Elso
Redfield, Jessie.....Twin Bridges
Reynolds, Grace Bozeman
Smart, Lena Bozeman
Snow, Edith M. Blaine
Stevens, Nettie Bozeman
Stuckey, Ida B. Deer Lodge
Uhl, Hedwig Clyde Park
Vanderbeck, Alice ...Virginia City
Vichers, Ada Virginia City
Walker, Montana Bozeman
Wilson, Anna Bozeman

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SHORT AGRICULTURAL COURSES

Bade, H. L. Dairy Big Timber
Bade, L. C. Creamery Big Timber
Border, J. T. Dairy Bozeman
Border, Mrs. J. T. Dairy Bozeman
Brown, J. A. Farmers and Dairy.....Melrose
Campbell, N. S. Dairy Bozeman
Church, C. L. Dairy Deer Lodge
Cleland, C. C. Dairy Laurel
Close, W. L. Farmers and Dairy..Hibbing, Minn.
Couper, Geo. B. Dairy Bozeman
Couper, Mrs. Geo. B. Dairy Bozeman
Dana, Geo. W. Dairy Deer Lodge
Fitzpatrick, M. T. Creamery Avon
Gibbs, J. T. Dairy Bozeman
Hawkins, W. B. Dairy Absarokee
Hodgman, W. Dairy Bozeman
Huth, Louis E. Creamery Osborn
Jenni, Fred Farmers and Dairy Lewistown
Kirschner, J. W. Dairy Bozeman
Mainland, J Dairy Great Falls
Martin, J. Lester Farmers and Dairy Twin Bridges
Maynard, A. D. Dairy Bozeman
Maynard, Irvine Dairy Bozeman
Maynard, Morris Dairy Bozeman
Metcalf, J. Dairy Bozeman
Nash, W. J. Dairy Bozeman
Oliver, C. L. Farmers Joliet
Roth, Wm. Dairy Bozeman
Roth, Mrs. Wm. Dairy Bozeman
Redfield, J. M. Dairy Pageville
Scholten, Garrett Creamery Big Timber

Shrader, James Dairy Livingston
Spore, James Dairy Boulder
Thompson, W. H. Dairy Great Falls
Young, A. R. Dairy Great Falls
Zinker, Carl Dairy Bozeman

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SCHOOL OF MUSIC

PIANO

Accola, Estelle Bozeman
Alward, Coda Bozeman
Bancroft, Alma Bozeman
Beley, Fred Livingston
Benge, Faith Winterset, Ia.
Bromley, Mary Bozeman
Buell, Gelia Bozeman
Buell, Vera Bozeman
Callaway, G. R. Virginia City
Carmichael, Effie Bozeman
Cameron, Gertrude Bozeman
Carr, Irene Bozeman
Catron, Pearle Bozeman
Clark, Olive... Hunter's Hot Springs
Corrie, Eva... Bozeman
Cunningham, Myrma Bozeman
Davidson, Mary Bozeman
Featherston, Mrs. J. H. ..Bozeman
Feazell, Grace Bozeman
Fiske, Gretchen Helena
Flager, Ruth Red Lodge
Fox, Hazel Bozeman
Fransham, Edna Bozeman
Franzman, Gladys Phillipsburg
Gray, Florence Bozeman
Hagerman, Edna Great Falls
Harris, Vera Bozeman
Hartman, June Bozeman
Hartman, Leah Bozeman
Hendrie, Mabelle Lewistown
Hey, Mrs. Geo. W. Bozeman
Hollier, Georgia Bozeman
Hoy, Katharine Bozeman
Jacobs, Lillian Columbus
Jeffers, Bertha Jeffers
Joslyn, Mignon Deer Lodge
Keene, Virginia Townsend
King, Gladys Bozeman
Kirk, Grace Salesville
Kirschner, Hortense Bozeman
Kountz, Josephine Bozeman
Lindsey, Estella Kendall
Linfield, Azalea Bozeman
Linfield, Leila... Bozeman
Maynard, Frances Bozeman
McCullough, Florence Gebo
Metcalf, Mollie Phillipsburg
Metheny, Blanch Bozeman
Naderman, Katherine Elso
Nickel, Adeline Darby
Nichols, Grace Bozeman
Phillips, Bessie Utica
Phillips, Delia Lewistown
Phillips, Elizabeth Lewistown
Phillips, Mary Lewistown
Piedalue, Irene Bozeman
Quaw, Eugene Bozeman
Roberson, Elizabeth Sixteen
Roecher, Chester Bozeman
Roschie, Zoella Bozeman
Schumacher, Hettie Bozeman
Scott, Margaret Logan
Settle, Ruby Bozeman
Shiell, Helen Straw
Smart, Lena Bozeman
Smith, Erma Bozeman
Smith, Inez... Bozeman
Snider, Leta Bozeman
Snow, Edythe May Blaine
Snow, Mrs. F. C. Bozeman
Stucky, Ida Belle Anaconda
Swingle, Mrs. D. B. Bozeman
Switzer, Madge Bozeman
Thorpe, Florence Bozeman
Topel, Clara Bozeman
Vickers, Ella Virginia City
Walker, Maryette Ft. Benton
White, Earl Bozeman
Wilson, Elva... Bozeman
Work, Vida Bozeman

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VOCAL

Allison, Jay H. Phillipsburg
Anderson, Vera Bozeman
Baker, Lulu... Bozeman
Bancroft, Clark Bozeman
Bancroft, Ross Bozeman
Damerell, Cora Bozeman

Fisher, Helen Bozeman
Fisher, Wallace Bozeman
Hagerman, Edna Great Falls
Hayes, John Clancy
Henegan, Ruth Bozeman
Jacobs, Lillian Columbus
Jackson, Grace Harrison
Kimpton, Addie Radersburg
Kirby, Vesta M. Gebo
Kountz, Mamie Bozeman
McLeod, Bertha Bozeman
McCullough, Florence Gebo
Morgan, George Bozeman
Murphy, Ethel Bozeman
Nickel, Adeline Darby
Phillips, Elizabeth Lewistown
Quaw, Mignon Bozeman
Smith, Mrs. May Bozeman
Spain, Roy Bozeman
Spieth, Frieda Bozeman
Snow, Edith Twin Bridges
Stevens, Josie Bozeman
Redfield, Jessie Twin Bridges
Wilson, Anna Bozeman
Walchli, Fred Kalispell

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VIOLIN

Carlson, W. W. Bozeman
Conrow, Carl Bozeman
Davidson, Paul Bozeman
Fisher, Barnett Bozeman
Griffith, George Bozeman
Kinney, Martha Bozeman
Lannin, Earl Butte
Peck, Harry Garneill
Piper, Lawrence Livingston
Reed, Harold Bozeman
Stiff, Elbert Bozeman
Stiff, Glenn Bozeman

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SUMMARY

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Art 9
Preparatory School 120
School of Agriculture 25
Home Science, 1 year 25
Short Agricultural Courses 36
Music (not taking other work) 57
Total (none counted twice) 446

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Bulletin of THE MONTANA STATE COLLEGE OF AGRICULTURE *and* MECHANIC ARTS.

FOUNDED EIGHTEEN HUNDRED NINETY-THREE

VOLUME 7 FEBRUARY, 1910 NUMBER 3

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THE
NATIONAL
MALL

SEVENTEENTH

ANNUAL CATALOGUE

Montana

State College of Agriculture and Mechanic Arts.

1909 - 1910.

Republican-Courier Print
Bozeman, Montana.



Calendar.

1910.

Registration and Examinations for Entrance and Conditions, ...Monday and Tuesday, September 12 and 13.
Instruction Begins..... 8:30 A. M., Wednesday, September 14.
Columbus Day, a Holiday..... Wednesday, October 12.
School of Agriculture Begins..... Tuesday, October 18.
Standing of Students Reported.....Friday, October 28.
Thanksgiving Recess.....Thursday and Friday, November 24 and 25.
Standing of Students Reported..... Friday, December 17.
Christmas Vacation Begins.....12:30 P. M., Wednesday, December 21.

1911.

Vacation Ends.....8:30 A. M., Wednesday, January 4.
Examinations Begin..... 9:00 A. M., Monday, January 23.
Examinations for Conditions....Friday and Saturday, January 27 and 28.
First Semester Ends..... Friday, January 27.
Registration for Second Semester Tuesday, January 31.
Instruction Begins..... 8:30 A. M., Wednesday, February 1.
Lincoln's Birthday, a Holiday..... Sunday, February 12.
Washington's Birthday, a Holiday... Wednesday, February 12.
Standing of Students Reported..... Friday, March 10.
School of Agriculture Ends Friday, March 31.
Standing of Students Reported..... Friday, April 21.
Arbor Day, a Holiday..... Tuesday, May 9.
Examinations Begin... 9:00 A. M., Monday, May 29.
Memorial Day, a Holiday..... Tuesday, May 30.
Examinations for Conditions.....Friday and Saturday, June 2 and 3.
Baccalaureate Address..... 8:00 P. M., Monday, June 5.
Class Day Exercises..... 2:00 P. M., Tuesday, June 6.
Preparatory School Graduation.....8:30 P. M., Tuesday, June 6.
Alumni Banquet..... P. M., Wednesday, June 7.
Commencement Day..... Wednesday, June 7.

Montana State Board of Education

GOVERNOR EDWIN NORRIS, (ex-officio) Chairman.....Helena.
ATTORNEY GENERAL ALBERT J. GALEN, (ex-officio) Helena.
STATE SUPT. W. E. HARMON, (ex-officio) Secretary.....Helena.

By Appointment.

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ROY AYERS.....Lewistown.
(Term expires February 1, 1911.)

O. P. CHISHOLM.....Bozeman.
S. D. LARGENT.....Great Falls.
(Term expires February 1, 1912.)

G. T. PAUL.....Dillon.
H. G. PICKETT.....Helena.
(Term expires February 1, 1913.)

JOHN M. EVANS.....Missoula.
NATHAN R. LEONARD Butte.
Term expires, February 1, 1914.)

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In Charge of the College and Experiment Station.

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By Appointment.

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Term expires April, 1913.)
J H. BAKER.....Bozeman.
(Term expires April, 1911.)
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Faculty

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Professor of Chemistry.

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Professor of Electrical Engineering.

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Professor of Horticulture.

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Professor of Veterinary Science.

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Assistant Professor of Zoology.

MISS HELEN R. BREWER, A. B., (Grinnell College).
Assistant Professor of History and Latin.

* Resigned January 1, 1910.

MISS MARY A. CANTWELL.
Principal of the Preparatory School and
Assistant Professor of English.

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Assistant Professor of Physics.

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Assistant Professor of Pharmacy.

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Instructor in Poultry Management.

MRS. EDNA GAGE
Instructor in Art.

MISS FRIEDA BULL, B. S., (Montana Agricultural College).
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Instructor in Chemistry.

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Instructor in Animal Industry.

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Instructor in Agronomy.

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Instructor in Home Science.

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Instructor in Mechanical Engineering.

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Instructor in Dairying.

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Assistant in Mechanical Engineering.

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MAYME KOUNTZ,
Assistant in Art.

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Instructor in Vocal Music.

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Instructor in Piano.

LOUIS L. HOWARD,
Band Instructor.

MRS. MARY K. WINTER,
Librarian.

GEORGE R. CALLAWAY,
Secretary and Accountant.

STANDING COMMITTEES.

AGRICULTURE—Atkinson, Cooley, Clark, Whipple, Taylor.
ASSEMBLY—Ham, Duddy, Sontum.
ATHLETICS—McIntosh, Currier, Swingle.
BUILDINGS—Clark, Mollett, Thaler.
COMMENCEMENT—Miss Brewer, Miss Cantwell, Sontum.
ENGINEERING—Thaler, Dearborn, Kneale, Snow, Carlson.
LIBRARY—Hamilton, Cobleigh, Thaler.
PUBLICATIONS—Brewer, Swingle, Kneale.
REGISTRATION—Currier, Miss Brewer, Ham.
SCHEDULE—Tallman, Miss Cantwell, Dearborn.
SCIENCE—Cobleigh, Tallman, Brewer, Cooley, Miss Harkins.
STUDENT ORGANIZATIONS—Currier, Atkinson, Miss Brewer, Spaulding, Miss Ballinger.

Montana Experiment Station

STATION STAFF.

F. B. LINFIELD, B. S. A., Director.
R. A. COOLEY, B. S., Entomologist.
O. B. WHIPPLE, B. S., Horticulturist.
W. J. ELLIOTT, B. S. A,, Dairyman
ALFRED ATKINSON, B. S. A., Agronomist.
ROBERT W. CLARKE, B. Agr., Animal Industry.
EDMUND BURKE, B. S., Chemist.
DEANE B. SWINGLE, M. S., Botanist and Bacteriologist.
W. J. TAYLOR, D. V. M., Veterinarian
REUBEN M. PINCKNEY, B. S. A. M., Assistant Chemist.
J. B. NELSON, Sup't. Dry Farm Work.
L. F. GIESEKER, B. S., Assistant Agronomist.
WM. F. SCHOPPE, B. S., Assist. Poultryman.
W. W. SPAIN, B. S., Assist. Agricultural Engineer.
H. E. MORRIS, B. S., Assistant Botanist.
H. P. GRIFFIN, B. S., Assist. in Animal Industry.
N. B. LUNDWALL, Clerk.

In connection with the college, the Montana Agricultural Experiment Station is conducted. The object of this station is to further the interests of the agricultural industries of the State of Montana. This is done by conducting researches and experiments, which may include the physiology of plants and animals; the diseases to which they are severally subject, with remedies for the same; the chemical composition of useful plants at their various stages of growth; the various subjects connected with irrigation; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soil and water; the chemical composition of manures, natural and artificial,, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly upon the agricultural industry of Montana as may seem advisable.

The experiment station farm, consisting of 380 acres, adjoins the college grounds. It is provided with the necessary barn, granaries, tool houses, farm implements, live stock gardens, greenhouses and orchards.

Sub-stations for experimental work in dry farming are maintained in various parts of the state and are conducted in co-operation with the railroads and the United States Department of Agriculture. A sub-station for experiments in horticulture has been established in the western part of the state.

The Montana Experiment Station is supported by the annual appropriations from the Federal government under the Hatch and Adams Acts, supplemented by growing appropriations from the state.

The station issues during the year a series of bulletins, which put in practical form the results of the experimental work. These are sent, upon request, to any citizen of Montana who will apply for them, and any such may have his name entered upon a mailing list and receive all bulletins as soon as issued.

Address, Director, Experiment Station, Bozeman, Montana.

The College of Agriculture and Mechanic Arts.

AIM AND SCOPE.

The purpose of the colleges of agriculture and mechanic arts is chiefly to provide industrial education in agriculture, engineering, household economy, and applied science, for the young men and women of the respective states in which they are located. The scope of the Montana Agricultural College is set forth in the two so-called Morrill Acts of Congress, which authorized this class of institutions and supplied in part endowment and funds for maintenance; and in an act of the Montana Legislature accepting the land and money grants from the national government.

The first Morrill Act of Congress of July 2, 1862, making a land grant for the partial endowment of the agricultural and mechanical colleges states that the income from these lands shall be used to maintain colleges "where the leading object shall be, without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

The second Morrill Act of Congress, August 30, 1890, making an annual appropriation out of the treasury of the United States for the further support and endowment of these colleges, provides that this fund is "to be applied only to instruction in agriculture, and mechanic arts, the English language, and the various branches of mathematical, physical, natural and economic sciences with special reference to their application to the industries of life; and to the facilities for such instruction."

The Act of the Montana Legislature, approved February 16, 1893, accepts these grants of lands and money and states that the Montana Agricultural College shall have for its object "instruction and education in the English language, literature, and mathematics, civil and mechanical engineering, agricultural chemistry, animal and vegetable anatomy and physiology, the veterinary art, entomology, geology, and such other natural sciences as may be prescribed by the State Board of Education; political, rural and household economy, agriculture, horticulture, history, bookkeeping and especially the application of science and the mechanical arts to practical agriculture in the field, and irrigation and the use of water for agricultural purposes."

ENDOWMENT.

The Enabling Act, providing for the admission of Montana into the Union, approved February 22, 1889, Sec. 16, grants 90,000 acres of land to Montana for the use and support of an agricultural college according to the terms of the Act of Congress, July 2, 1862, and Sec. 17, grants



COLLEGE HALL.



AGRICULTURAL HALL.

an additional 50,000 for the same purposes, and subject to the same conditions and limitations as the other grant. The 140,000 acres of land cannot be sold for a price less than $10.00 per acre, and the principal, together with all money received from the sale of timber, is to be invested as a permanent endowment. The unsold lands may be leased and the rentals together with the interest on the permanent endowment shall be used for the maintenance of the college.

The Act of Congress of August 30, 1890, appropriates $25,000 annually out of the treasury of the United States. By the Nelson bill, passed March 3, 1907, this amount is increased annually by $5,000 each year, beginning in 1907, until the total annual appropriation shall reach $50,000, at which figure it shall remain.

Both the Acts of July 2, 1862, and August 30, 1890, contain this clause: "No portion of the funds, nor the interest thereon, shall be applied, directly or indirectly, under any pretense whatever, to the purchase, erection, preservation, or repair of any building, or buildings."

LOCATION.

Bozeman, the county seat of Gallatin county, is on the main line of the Northern Pacific railroad. For convenience, healthfulness and beauty of surroundings, the location is unsurpassed. The college is situated on an elevation which commands a view of one of the most fertile valleys in the world, covered far and wide with grain fields, and hemmed in on all sides by lofty mountains.

Bozeman is a city of homes and churches, with a wholesome moral environment. It is a most desirable residence city for families who wish to educate their children. Expenses are moderate and there are all the conveniences of a modern city. The college is reached from the railroad station and city by the electric car.

CAMPUS AND FARM

The grounds and farm contain three hundred and eighty acres. Forty acres in the immediate vicinity of the building constitute the campus and recreation grounds, which are in lawn, interspersed with flower beds, shrubbery, trees and driveways. The remainder is used for farming and experimental purposes.

BUILDINGS.

College Hall, situated in the center of the college campus is a substantial structure of brick and stone, having a total length of one hundred and twenty-eight feet and a width of ninety feet It is three stories high and has a basement, which furnishes quarters for mechanical drawing and three class rooms. The north half of the second floor is devoted to the art department, the arrangement being such that three large

rooms can be thrown together, by sliding doors. The south half of the second floor is used by the department of civil engineering, and has one office, one seminar room, two recitation rooms and a drawing room. The third floor contains the large assembly hall, a literary hall and five class and music rooms.

Agricultural Hall is a three story building, one hundred and fifty feet by sixty-eight feet, pressed brick, tile roof, maple floors and modern equipment throughout. The north half of the first floor contains the quarters for dairying, consisting of storerooms, office, class room, butter and cheese rooms and laboratories. The south half of this floor is used for horticulture and has seed room, office, class room, work room and laboratory. The north half of the second floor is occupied by the agronomy department with office, class room, dry land office and soil and grain laboratories. In the south half are offices for the director of the experiment station, superintendent, of farmers' institutes, class room, office and laboratory for the department of animal industry. The third floor is devoted to home science and contains two large kitchens, two dining rooms, two class rooms, three sewing rooms offices and one room for training in nursing.

The Chemistry and Physics Building is located west of College Hall. It is sixty by one hundred feet, of pressed brick, and is three stories high including the basement. The basement is occupied by the physics lecture room, pharmacy lecture room and laboratory, the mineralogical and assay laboratory, and the museum of geology and mineralogy. The main floor is occupied by the office and department library a lecture room, a preparation room, and the experiment station laboratory. The east half of the second story contains the laboratories for physics and the west half the qualitative and the quantitative laboratories. The north tower is used for the meterological observatory and a fine set of registering instruments is installed in it.

The Biology Building, consisting of three stories and basement is brick veneered. On the top floor is a lecture room and a museum containing the zoological collections. On the floor below are three laboratories for bacteriology, botany and zoology, and an office and work room for the botanist. The west half of the first floor is a large laboratory for general biology and the east half is occupied by the office library and work room for the entomologist. The basement contains work rooms, class room, store rooms, herbarium room and dark room. Attached to this building on the south is a greenhouse, 50 by 36 feet, for botanical purposes, and an insectary, 18 by 10 feet, for the study of living insects.

The Engineering Laboratory is a two story stone building, 55 by 33 feet, with a frame annex 36 by 20 feet. The first floor contains the dynamos, motors, two steam engines and strength of material testing machines. The second story is occupied by the storage battery, photometer and electric light rooms, class room and the office of the professor of electrical

engineering. The first floor of the annex contains the cement laboratories, and the second floor is used for electrical designing.

The Shop Building is a one-story frame. The main part is 60 by 100 feet and contains a forge shop 27 by 60 feet, a machine shop 44 by 72, an office, a wash room, and a tool room. It has one wing 36 by 50 feet for woodwork and another 36 by 48 feet for foundry.

The Power House is a brick structure, 32 by 76 feet, centrally located with reference to the principal college buildings. It contains an eighty horse-power tubular boiler, a one hundred and twenty-five horse-power Root water-tube boiler, a sixty horse power engine, directly connected with a forty K. W. commercial dynamo, and coal storage bins. The engine and generator furnish power for electric lights, the ventilating fans, the shop and laboratory machinery.

The Gymnasium is a frame building, 100 by 60 feet, with two rooms each 14 by 12 feet on the south end, fitted with shower and needle baths. This building is heated and lighted and has a good floor for gymnasium work. In the south end are two dressing rooms each 28 by 12 feet, with lockers. Along each side and at the ends are permanent seats, amphitheatre style. The hall furnishes a convenient place for gymnasium practice, basket ball and other indoor athletics.

The Cattle Barn is a two-story frame building 120 by 86 feet and of fine architectural appearance. On the first floor is the dairy stable, quarters for young stock, a stock judging room, 40 by 40 feet, box stalls, feed bins and offices. The second story is used for storage of hay. All stables have cement floors and iron stalls.

The Veterinary Building is a two-story frame structure, 25x40 feet, with a one-story wing 20 by 40 feet. On the first floor are the office of the veterinarian two laboratories and an operating room. The second floor contains a laboratory and a class room.

The Horse Barn is a two-story frame building 86 by 44 feet. It contains a living room, carriage room, feed bins, fourteen single stalls, three double box stalls, and space for 100 tons of hay.

The Beef Cattle Barn is 50 feet square with two wings each 24 by 28. It is equipped for feeding experiments and has feeding pens, space for hay, grain bins, and weighing room.

The Sheep Barn has a main part 40 by 50 feet and two wings, one 20 by 72 feet, the other 20 by 88 feet. In addition to the pens this building is provided with root cellar, wool and shearing rooms, hay loft, feed bins, and room for the attendant.

The Seed Barn and Granary is a two-story building and affords ample storage room for the field crops on the station farm.

The Piggery consists of a main building, 30 by 35 feet, with two wings, 16 by 50 feet each. In the main building are the feeding rooms and slaughter room, while the wings provide six pens each, for the hogs.

The Poultry Plant consists of two buildings. The first is 122 feet long

by 15 feet wide. In the center is an office and feed room, under which is an incubator cellar and heating plant. One wing is a brooder house, the other contains six pens, with yards 100 feet long on either side. The other building is 120 feet long and contains eight pens with yards.

The Station Heating Plant is a neat brick structure just west of the biology building, and furnishes the steam for the adjacent buildings.

BOARD AND ROOM.

The Woman's Dormitory, which will be completed December 1st, 1910, is 116 by 58 feet, three stories and basement. It is constructed of pressed brick, has tile roof, maple floors, Oregon fir finish and will be equipped with baths, electric lights and steam heat. The rooms are in suites and single and most of them will have hot and cold water. In the basement is the kitchen, the store room, the laundry, a large dining room and quarters for the servants. The first floor contains the reception rooms, office, matron's suite and some students' rooms. The second and third floors are entirely for students. Rent of rooms will vary from $5.00 to $10.00 per month, according to location and number in room. Table board will be furnished to all whether living in or out of the building, at a price not to exceed $4.50 per week.

There is no men's dormitory connected with the college but about twenty young men can be accommodated at the club on the campus where rooms and board may be had for $19.00 and $20.00 per month. Students who do not live in the dormitory or at the club find room and board in private families convenient to the college, at from $18.00 to $25.00 per month. The total college expense for the year, including tuition, books, room, board and incidental expenses may be estimated from $250.00 to $350,00. A list of approved places with prices and accommodations is kept in the president's office. A committee of students meets all trains on registration days and at other times on request, and aids in finding satisfactory locations.

FEES.

1.—Annual matriculation fee for college, preparatory, pharmacy, art and one year home science course.....$12.00
2.—Annual matriculation fee for school of agriculture..... 6.00
3.—Annual matriculation fee for four weeks' course in dairying and short agricultural courses..... 2.00

DEPOSITS.

Agriculture.—Agron. (3); Dairy (1), (2), (a), or (c) per semester	$ 2.00
Art.—Art (1), (2), (3), (4), (5), (6), (7), (8), (a), or (b) per semester	1.00
Art (9) per semester	5.00
Biology—Biol. (a) or (b) per semester	1.00
Biol. (4), (5), (6), (c) or (d) per semester	1.50
Biol. (10) or (12) per semester	6.00
Biol. (1), (2), (3), (9), (11), or (13), per semester	3.00
Chemistry.—(1) per year	8.00
Chem. (a) per year	3.00
Chem. (6) per semester	2.00
Chem. (2), (3), (4), (7), (10), or (11), per semester	6.00
Chem. (12) per semester	25.00
Engineering.—C. E.—(1), (4), (13), (15), (19), or (20) per year	1.50
C. E. (29) per semester	1.00
C. E. (11) per semester	6.00
E. E. (4), (6), (10), or (12) per semester	3.50
M. E. (14) or (15a) per semester	1.00
M. E. (20) per semester	3.50
M. E. (2), (6), (9), (12), (17), (21), or (27) per year	6.00
M. E. (a), (b), (c), (d), (e), (f), (g), or (h) per year	4.00
Home Science.—H. S. (8), (a), (b), or (g), per year	3.00
H. S. (1) or (5)	2.00
H. S. (4) or (7)	4.00
H. S. (2)	5.00
H. S. (11), (12), (13), (14), (15), (c), (d), or (h) per yr.	.50
Physics.—Phys. (la), (2), (4), (6), or (7), per year	1.00
Pharmacy.—Phar. (1), (5), (6), or (7), per semester	2.00
Phar. (10) per semester	4.00
Phar. (8) per semester	6.00
Phar. (4) per semester	8.00

A fee is a fixed charge and no part of the fee is returned to the student. The deposits in most cases are intended to cover the cost of materials and breakage of equipment in the laboratory and any balance of the deposit not required for this purpose is returned to the student at the close of the semester or year.

ADMISSION.

Admission to the freshman class, in any of the college courses, is granted: (a) By a certificate of graduation from an accredited high school, (b) By examination in the subjects required by the college for entrance, (c) By faculty approval of grades from other than accredited high schools, (d) By graduation from the preparatory school.

Candidates for admission to the preparatory school, the one year course in domestic science and the school of agriculture, must have completed the eighth grade in the public schools or its equivalent. One year of high school work is required for admission to the school of pharmacy. There are no set requirements for art, music and the short agricultural courses, all being admitted who give evidence of being able to profit by the work. All candidates for admission to the institution in any department whatever are required to present the requisite diplomas or certificates for work previously done in other schools and no registration is complete until such credentials are presented and passed upon.

ENTRANCE REQUIREMENTS.

Fifteen units are required for admission to the freshman class in any college course.

Any one with not less than thirteen units may be admitted conditionally, but the units of preparatory work which have not been offered at entrance must be given preference over college subjects.

A unit for admission shall consist of work to the amount of five recitation periods per week of forty-five minutes each or of four recitation periods per week of sixty minutes each, for a year of not less than thirty-six weeks

Two periods of laboratory, shop work, or drawing shall count as one recitation.

The following seven units are required of all applicants:

English 3
Physics 1
Mathematics 3

The remaining eight units shall be presented from the following list:

English 1
German 2 or 3
French 2 or 3
Latin 2, 3 or 4
Biology, or Botany, or Zoology ..1
Trigonometry ½
Physiology ½
Phys. Geography ½
Chemistry 1
General History 1 or 2
English History 1
American History 1
Freehand Drawing 1
Agriculture 1 or 2
Mechanical Drawing 1
Shop Work 1 or 2
Home Science 1 or 2

ACCREDITED HIGH SCHOOLS.

Following is a list of the accredited high schools of the state:

(1) **City High Schools**—Anaconda, Billings, Butte, Chinook, Columbus, Forsyth, Fort Benton, Glasgow, Great Falls, Havre, Helena, Whitehall and Virginia City.

(2) **County High Schools**—Beaverhead, Dillon; Broadwater, Townsend; Carbon, Red Lodge; Custer, Miles City; Dawson, Glendive; Fergus, Lewistown; Flathead, Kalispell; Gallatin, Bozeman; Granite, Philipsburg; Jefferson, Boulder; Missoula, Missoula; Park, Livingston; Powell, Deer Lodge; Sweet Grass, Big Timber; Teton, Choteau.

REGISTRATION.

Registration and Assignment of Work.—All students are registered in the president's office, and each one is then assigned to a member of the faculty, called a class officer. The class officers arrange the studies and it is their duty to advise with the students regarding all questions which arise in connection with their studies and to investigate complaints of unsatisfactory work. Students should consult with the class officers when in need of assistance or information.

Unless permission is granted by the faculty, class officers will register all students in accordance with the rules governing prerequisites, failures, and number of credits. The registration committee will examine all credentials for admission, and all grades earned in this and other institutions and report any irregularities in registration to the faculty. No registration shall be considered final until approved by the committee or the faculty.

Amount and Regularity of Work.—Students under twenty-one years of age will be admitted only to regular courses or to work as nearly regular as their preparation allows, unless on special action of the faculty. Students over twenty-one will be admitted to such work, not less than twelve credits, (allowance being made for music) as the schedule permits and their class officers approve.

Change of Registration.—A student desiring to change his studies will present his request to his class officer, who, after consulting all teachers interested, will take such action as he may deem best. Change in registration will be made after four weeks for extraordinary reasons only. Requests for change in registration will not be considered during the last eight weeks of a semester.

A change in course of study is allowed by a vote of the faculty only.

ATTENDANCE

Attendance.—A student tardy or absent from any class will present the reason for the tardiness or absence at the first appearance at such class after the tardiness or absence has occurred. The teacher will be the judge of the sufficiency of the excuse. A student absent from class the third consecutive time will be reported to the class officer and the president. A student who has been three times absent (two tardinesses counting as one absence) and is unable to present a satisfactory excuse is immediately suspended and will be reinstated only by a vote of the faculty.

Leave of Absence.—When it is necessary for a student to be absent from the city application must be made to the president for leave of absence. A leave of absence is a justification for absence from class but does not give relief from the work omitted.

GRADES.

Passing Grades.—An average standing from 90 to 100 is A, from 80 to 90 is B, from 70 to 80 is C, from 60 to 70 is D, from 50 to 60 is E, below 50 is F.

All students, one half of whose work shall have received the grade of A, will be recommended for the degree "With Honors."

Conditions and Failures.—An average standing of less than fifty per cent for any semester's work shall be termed a "failure," and the work must be made up by repeating the subject the following year. An average standing for the semester of more than fifty per cent and less than sixty per cent shall be termed a "condition." A condition must be removed by a special examination before the beginning of the semester in which the subject is next taught. If not removed within this limit the condition shall become a failure, to be made up by immediately repeating the subject. Examinations for removing conditions shall be held on the Monday and Tuesday preceding the beginning of the college year, and on the last Friday and Saturday of each semester, and at no other time. Laboratory work falling below the grade in quality or quantity shall be marked deficient and shall be made up within the same time limit as conditions.

Students whose work is unsatisfactory will be reported to the class officer and the president and information will be sent to the parents or guardians.

Credits—For convenience in estimating the requirements for a degree, the following rules are laid down: One hour a week, for a semester, of recitation or lecture work, or two and one half hours a week for a semester, of laboratory, shop, library work, or drawing, shall count as one credit.

If for any reason the full time is not occupied in the shop, laboratory, drawing room or library, the remainder shall be used under the supervision of the instructor for outside work.

No regular student may take in any one semester work amounting to less than twelve credits, nor more than nineteen, unless a greater number are prescribed in the course.

Grades brought by a student from another institution will be accredited in this college only after personal conference with and approval by the head of the department in which credit is desired.

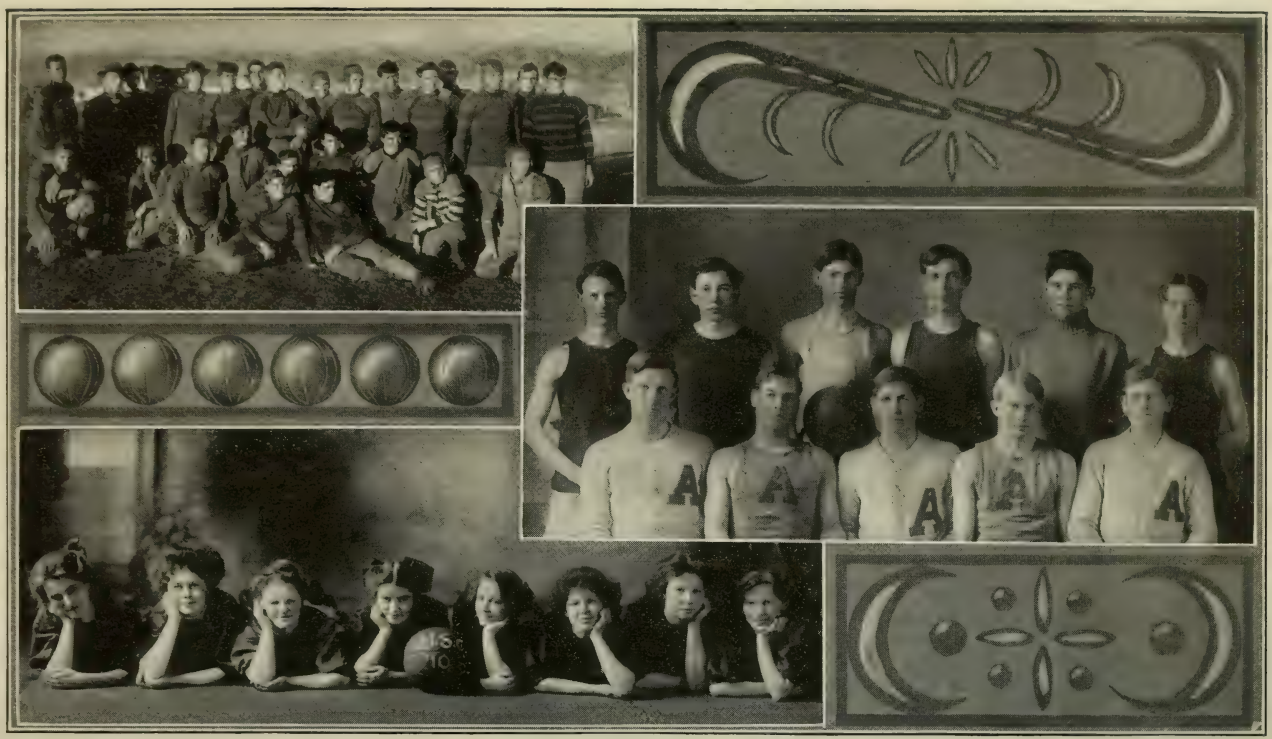
GRADUATION AND DEGREES.

Bachelor's Degree.—Candidates for the bachelor's degree must complete satisfactorily one of the college courses as outlined and not less than 130 credits; including also a thesis the value of which in credits shall be determined by the instructor concerned. Students who are relieved for any reason of the requirements in military drill shall present four additional credits in some other subjects.

The degree of Bachelor of Science is conferred upon a student com-



SENIOR CLASS.



ATHLETIC TEAMS.

pleting the work prescribed in any one of the college courses and the name of the course taken is placed on the diploma.

Master's Degree.—The candidate must hold a bachelor's degree from this college or another of at least equal rank, and in the line of work for which he applies for the master's degree or he shall have sufficient preparation in his major subject to enable him to carry on research work. He shall complete one full year of resident study of not less than 32 credits.

There shall be one major subject and one or two minors, the major being equal to ten credits per semester. The plan of the work must be approved by the committee on graduate work by October 1. The candidate shall also present a thesis embodying the results of original research, which may be part of the credits required for the major subject.

Engineering Degrees.—Resident graduates in engineering may earn the degree of Civil Engineer, of Electrical engineer, or of Mechanical Engineer, on the same basis as candidates earn the degree of Master of Sciences. Non-resident graduates in engineering must have at least three years of successful professional experience, must present an acceptable thesis, and must pass an examination before the special committee on degrees.

MISCELLANEOUS.

Government.—Students are expected to conduct themselves as ladies and gentlemen; those who fail to comply with this demand will be requested to leave the institution.

Work for Exhibition.—It is required that students who have done work suitable for exhibition purposes shall place such work at the disposal of the institution for the period of one year.

Assembly.—Students are required to attend the weekly assembly, at which lectures are delivered by members of the faculty and others.

Student Organizations.—All public performances, given by students or student organizations, using the name of the college, will be under the supervision of the committee on student organizations.

Military Drill.—All male students, except aliens, those physically disqualified, members of the junior and senior classes, and student assistants, are required to take military drill, satisfactory work being requisite for graduation.

Honorable Dismissal.—Students intending to sever their connection with the institution, either indefinitely or permanently, should report as soon as possible to the president, either in person or in writing, giving proper explanation, and should apply for an honorable dismissal. Students leaving the institution without such honorable dismissal (except at the end of the college year), will not be readmitted to the college at any later time, nor will any reports or grades in credit for work done here be sent out until satisfactory explanation is made.

COLLEGE ORGANIZATIONS.

Young Men's Christian Association.—The association is undenominational and is well fitted to promote the moral and religious life of students. It conducts mission and Bible study courses, and prayer meetings and secures addresses by religious workers. The association promotes good fellowship by giving social entertainments, assists new members to get started in college life and aids in securing employment for those who wish to work their way through college.

Young Women's Christian Association—The object of this association is the all around development of Christian womanhood. It co-operates with the Y. M. C. A. in its social and religious work among the students. It conducts devotional meetings and carries on systematic Bible study. Several delegates are sent to the Northwestern Conference each year and an active interest is maintained in the state association.

Both associations have neatly furnished rooms in which to hold meetings and transact business.

Literary Societies.—Three literary societies are maintained, the Arena for college young men, Hamiltonia for college young ladies, and the Philomathion for preparatory students. They give most excellent opportunity for practice in composition, declamation, oratory, debate and music.

Oratorical Association.—This organization has charge of all declamatory, oratorical, and debating contests, both between classes in the college and with the institutions that are comprised in the State Oratorical Association. All students are members of this association.

Engineering Society—This society admits as active members, all students in the regular college courses in engineering and as associate members, students taking engineering studies. The object is to increase interest in technical education by discussing the current questions and problems of the profession, and to aid its members financially by purchasing at wholesale rates, books, materials and instruments.

Agricultural Society.—All agricultural students are eligible to membership in this society. Regular meetings are held for the discussion of topics of interest to students in agriculture. The aim is to create a professional interest in scientific agriculture with special reference to the possibilities of farm life.

The Exponent.—A monthly publication, in magazine form, under this name, is maintained throughout the college year entirely under student supervision and control. Since Jan. 1, 1910, a Weekly Exponent has been published in cooperation with the monthly. The editor-in-chief has been selected annually by the student body. He appoints the staff from among those students who have taken interest in the paper and been its best contributors. The Exponent is the organ of the students.

Athletic Association.—This association has general control of all athletic interests of the college, subject to the approval of the faculty. Foot-

ball, base ball, basket ball, track and tennis are maintained. A part of the annual matriculation fee is appropriated to athletics and all students thus become members of this association without additional cost.

Pharmaceutical Society.—The society was organized for the purpose of arousing a greater interest in scientific matters of practical importance to the pharmacist. Monthly meetings are held and current events in pharmacy are discussed and scientific papers and talks are presented by the instructor, students, practical pharmacists, and others.

Branch of the American Institute of Electrical Engineers.—A branch of this society has been organized at the college. Regular monthly meetings are held at which original papers are read or those of the Institute discussed. Students and teachers are kept in touch with practical engineers and their problems. Only regular members or student members of the American Institute are eligible to membership in this branch. There is, however, an Electrical Club which includes all the members of the Institute and all other students in the electrical engineering course.

College Band.—The college band of forty-five members, under the instruction of Mr. Louis Howard is one of the best amateur musical organizations in the state. The college provides instruments music and instruction. The band is divided into two sections, beginners and experienced players. This gives a splendid opportunity both for those who have never played and those who have some skill in the use of instruments.

College Choristers.—This glee club of twenty voices has attained a high degree of skill in rendering popular and high class music. The annual concert is one of the chief events of the college year. A splendid opportunity is given students to cultivate their musical talent.

PRIZES.

Prize in Oratory.—An annual prize of twenty dollars is given to the winner in the annual local oratorical contest. This is open to all students. The winner represents the college in the state oratorical contest.

Armstrong Prize in Declamation.—Hon. F. K. Armstrong, of Bozeman, gives a prize of ten dollars to the winner of the annual declamatory contest of the preparatory school. There is also a second prize of five dollars. Only regular students are eligible.

SCHOLARSHIPS

The State Board of Education has established a four year scholarship in each of the accredited high schools for the student who receives the highest average grade in his class. These scholarships are awarded each year by the high school principals for their respective schools. This scholarship excuses the holder from paying any tuition or deposits. Any one winning a scholarship may choose any of the state institutions.

EMPLOYMENT FOR STUDENTS.

A number of students earn a part of their expenses while in college. Students expecting to work their way should come with sufficient money to pay their expenses for one semester unless they have engaged work in advance. The college cannot guarantee employment, but those who are willing to give efficient, faithful service have usually found work.

A few students are employed as janitors and as assistants in the shops, laboratories, and barns. Others care for furnaces, horses and cows in the city, work in stores and at various kinds of house work. Calls for young lady students to work for their board are numerous.

Students readily find employment at profitable wages during the summer vacation. A large number annually get work with the transportation companies in the Yellowstone National Park as drivers, camp attendants and domestics. Engineering students are placed with the reclamation service, the railroads, and the electric power plants.

A faculty committee aids students to find employment. Those desiring work should write, stating experience and kind of work desired.

LIBRARY AND READING ROOM.

Public Depositary—By Act of Congress the library is now a depositary and receives all public documents and other printed matter issued by the United States government.

Main Library.—The main library is in two large, well lighted rooms on the first floor of College Hall. The library contains 10,300 volumes, not counting public documents, and about 6,000 pamphlets. It is well supplied with standard works in technology, history, science and literature, as well as with dictionaries, cyclopedias and other reference works. About $1,500 is spent annually for books and periodicals.

Department Libraries.—The agricultural library occupies two rooms on the second floor of Agricultural Hall. It contains almost complete bound sets of all state experiment station bulletins and United States Department of Agriculture publications, besides a large number of agricultural papers and standard works. One large room on the first floor of the biology building is used for the library and periodicals of the biological department. The library of the chemistry department is located in the office of the chemist in the chemistry building.

ATHLETICS AND PHYSICAL TRAINING.

The gymnasium is described on page 11 of this catalogue. This furnishes some room for basketball practice and games, for baseball and football practice in bad weather and for gymnasium practice of various kinds during the winter months. A small amount of apparatus is available. The college furnishes the necessary equipment and materials for basketball, football, baseball and track athletics.

The work of this department includes three main lines,;—the coaching of athletic teams to represent the college in outside contests; the training of such men as present themselves during the winter for work in wrestling, boxing, and indoor work; and the general supervision of the physical welfare of all the students through a system of physical examination and prescribed exercises.

The college has been represented in inter-collegiate athletics during the past year by teams in basketball, track athletics, baseball, and football. All have done creditable work. Eligibility in these teams is determined under the rules of the Montana Inter-Collegiate Athletic Association.

The gymnasium work is open to all the students of the college and the preparatory school and a good deal of interest has been aroused. Wrestling and boxing matches have been used to entertain the spectators between the halves of basketball games.

At the middle of each college year all the students of the college are requested to present themselves for a thorough physical examination; and on the showing thus made the instructor prescribes certain forms of exercise for each student, and makes certain recommendations regarding diet and hygiene. At each recurring annual examination the improvements are noted and further suggestion made.

Organization of Instruction.

A. The following four year college courses, each leading to the degree of Bachelor of Science, are offered:

1.—Division of Agriculture.

1, Agronomy; 2, Animal Industry and Dairying; 3, Horticulture.

2.—Division of Engineering.

1, Civil Engineering; 2, Electrical Engineering; 3, Mechanical Engineering.

3.—Division of Science.

1, Biology; 2, Chemistry; 3, Home Science; 4, History-Literature; 5, Mathematics-Physics.

B. The following courses, not leading to a degree are offered:

1.—Preparatory School.

2.—School of Agriculture.

3.—School of Pharmacy.

4.—Art School.

5.—Music School.

C.—The following special courses are offered:

1.—Household Economy.

2.—Dairying.

4.—Livestock.

4.—Poultry.

Division of Agriculture.

Four-year courses are maintained in (1) Agronomy, (2) Animal Industry and Dairying. (3) Horticulture. The aim is to give a scientific and practical training for the agriculturist, the stockman, the dairyman and the horticulturist. The work is the same for the first two years. At the beginning of the junior year the student chooses the group in which he desires to specialize. The completion of the new agricultural building, the purchase of additional lands, and the erection of farm buildings and barns, afford ample accommodaion for the agricultural work. The equipment and other facilities are described in connection with the courses of study.

AGRICULTURE.

FRESHMAN YEAR

First Semester		Second Semester	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (Eng. 4)	1	Public Speaking (Eng. 4)	1
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
General Botany (Biol. 9)	5	Plant Physiology and Histology (Biol. 10)	4
Trig. and Log. (Math. 2a)	3	Prin. Plant Culture (Hort. 1)	4
Farm Dairying (An. Ind. 8)	3	Animal Types (An. Ind. 1)	3
Drill	1	Drill	1
	19		19

SOPHOMORE YEAR

Expository Composition (Eng. 2)	2	Expository Composition (Eng. 2)	2
Qualitative Analysis (Chem. 2)	4	Organic Chemistry (Chem. 5)	5
Gen. Des. Phys. (Phys. 1a)	3	Gen. Des. Phys. (Phys. 1a)	3
Invertebrate Zoology (Biol 1)	5	Animal Phys. and Anat. (Biol 3)	5
Field Crops (Agron. 1)	5	Geology (Geol. 1)	3
Drill	1	Drill	1
	20		19

Course in Agronomy.

Agronomy is the science of the field and its crops. It treats of the production and improvement of field crops, the cultivation of soils and the maintenance of their fertility; and general farm management, which is the application of economic business methods to farm practices.

Because of the peculiar agricultural conditions existing in western states, a new agriculture is being developed. The handling of dry farming lands is necessary only in the West. The problems which have to do with irrigation water, and the cultivation of the soil and management of the crops under irrigation must be solved by western investigators and agriculturists. It is to fit men to deal with these and other questions of production on the farm that this course is offered.

The first two years of the agronomy course are devoted to the study of the natural sciences, languages and some general agricultural work. This places the student in a position to appreciate and intelligently discuss the methods of practice taken up later in the course.

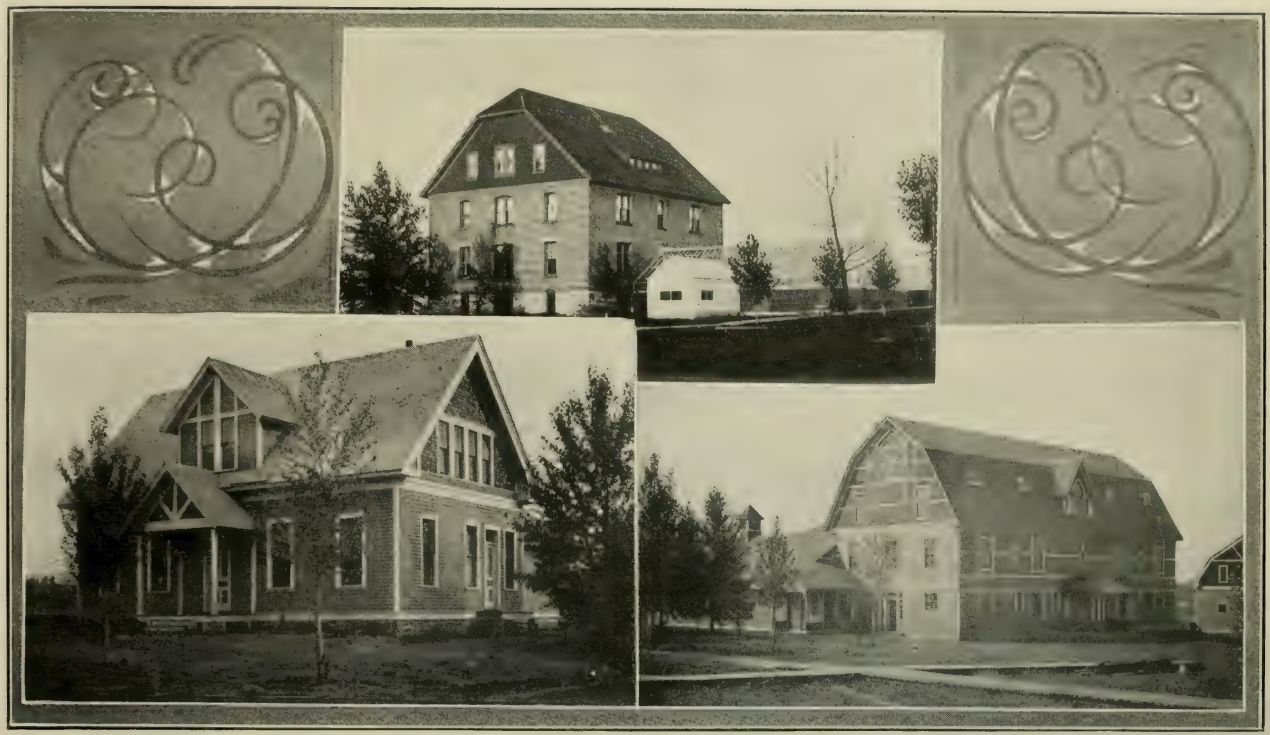
The last two years of the course are designed to give the student clear insight into methods for the cultivation and maintenance of the fertility of the soil; the peculiarities of the growth and handling of different crops; the arrangement, the laying out of the farm, and the principles which govern successful farm management.

With a constantly growing appreciation of the value of the agricultural lands of the west, comes an active demand for young men trained along the lines of practical and scientific agronomy, men who combine college training with practical experience and native ability. Such training is offered to young men in this course. The demand for such students is unlimited, at a compensation not exceeded in any other calling. A few of the many lines open to graduates of this department are: college and experiment station work, agricultural journalism, management of large irrigated and dry farms, management and salesmanships for seed firms, and superintendencies for companies with large land holdings.



HOME ECONOMICS CLUB.

AGRICULTURAL SOCIETY.



BIOLOGY BUILDING

VETERINARY BUILDING.

DAIRY BARN.

AGRONOMY

JUNIOR YEAR.

First Semester		Second Semester	
Economics (Econ. 3)	2	Economics (Econ. 3)	2
Soil Physics (Agron. 2)	5	Soil Fertility (Agron. 3)	3
Agricultural Chemistry (Chem. 7)	4	Farm Mechanics (Agron. 4)	3
Bacteriology (Biol. 12)	5	Plant Pathology (Biol. 11)	4
Elective	2 or 3	Organic Evolution (Biol. 14)	2
		Care and Management of Live Stock (An. Ind. 6)	3
		Elective	2
	18 or 19		19

SENIOR YEAR

Farm Management (Agron. 6)	4	Principles of Breeding (Agron. 7)	4
General Entomology (Biol. 4)	4	Soil Management (Agron. 8)	2
Plane Surveying (C. E. 1)	5	Sanitary Science (Vet. Sci. 6)	2
Thesis (Agron. 9)	2	Feeding Live Stock (An. Ind. 4)	3
Elective	4	History of Agriculture (Agron. 5)	2
		Thesis (Agron. 9)	2
		Elective	4
	19		19

Course in Animal Industry and Dairying.

The work in animal industry consists of study in judging, feeding, breeding, and caring for farm animals. The work in dairying consists of the handling, manufacture, and marketing of milk and its various products.

This course is designed to prepare young men for agricultural college and experiment station work, federal government work, farmers' institute work, positions as buyers and salesmen of livestock, teachers of animal industry and dairying in high schools, managers of large livestock and dairy farms, creamery and dairy inspectors, managers of dairy corporations, and community milk depots, and above all, to furnish men with a scientific as well as a practical knowledge to operate their own farms in Montana.

The first two years of this course are given largely to a study of basic subjects, as English, modern language, mathematics, physics, chemistry, and biology. The last two years are given to special practical and theoretical work in dairy manufactures, handling of milk, judging and feeding livestock, veterinary science, bacteriology, and other allied subjects.

This course is given through text books, lectures, practice, and observation. Lectures are given by specialists and the student is made familiar with the most modern ideas and acquainted with the methods of the most successful breeders, feeders, and dairymen in this and European countries. The work in judging is given by the use of college animals and stereopticon lectures. To secure a variety of animals, excursions are made to stock farms near the college. Advantage is also taken of the livestock on exhibition at the state and local fairs. Practical instruction is also given in compounding rations, making out pedigrees and keeping breeding records.

The theoretical work in dairying is closely followed with practical work in handling separators, testing milk, ripening and churning cream, and by all the actual work in the college creamery and cheese factory. The practical and theoretical are carefully combined.

ANIMAL INDUSTRY—DAIRYING.

JUNIOR YEAR.

First Semester		Second Semester	
Agricultural Chemistry (Chem. 7)	4	Animal Nutrition (Chem. 11)	3
Breeds of Live Stock (An. Ind. 2)	4	Poultry (An. Ind. 7)	3
Milk & Milk Testing (An. Ind. 9)	3	Veterinary Anatomy (Vet. Sci. 2)	3
Bacteriology (Biol. 12)	5	Vertebrate Zoology (Biol. 2)	4
Veterinary Physiology (Vet. Sci. 1)	3	Organic Evolution (Biol 14)	2
		Dairy Manufactures (An. Ind. 10)	4
		or Soil Fertility (Agron. 3)	3
	19		18 or 19

SENIOR YEAR

Care and Management of Live Stock (An. Ind. 6)	3	Care and Management of Live Stock (An. Ind. 6)	3
Obstetrics (Vet. Sci. 4)	4	Principles of Breeding (Agron. 7)	4
Stock Judging (An. Ind. 3)	2	Stock Judging (An. Ind. 3)	2
Herd Books and Pedigrees An. Ind. 5)	1	or Cheese Making (An. Ind. 11)	3
Embryology (Biol. 13)	4	Pathology (Vet. Sci. 3)	3
Thesis (An. Ind. 12)	2	Feeding of Live Stock (An. Ind. 4)	3
Elective	4	Thesis (An. Ind. 12)	2
		Elective	3 or 4
	20		20

Horticulture.

The four years' course in horticulture, leading to the degree of Bachelor of Science in horticulture, is designed to prepare students as teachers in agricultural colleges, investigators in the agricultural experiment stations, editors of horticultural papers, managers of fruit associations, and superintendents of commercial orchards and fruit plantations. The western United States leads the world in methods of orcharding and disposing of orchard products, and there is a strong and growing demand for persons properly trained to manage the orchard projects now operated throughout the fruit regions of the West. Fruit growing, when done in a scientific way, is extremely profitable and presents an inviting field for the trained horticulturist. The college offers good facilities for a thorough training in all branches of horticulture.



HORTICULTURE

JUNIOR YEAR.

First Semester		Second Semester	
Economics (Econ. 3)	2	Economics (Econ. 3)	2
Soil Physics (Agron. 2)	5	Soil Fertility (Agron. 3)	3
Bacteriology (Biol. 12)	5	Plant Pathology (Biol. 11)	4
Agricultural Chemistry (Chem. 7)	4	Vegetable Gardening and Small Fruit Culture (Hort. 3)	5
Pomology (Hort. 2)	3	Organic Evolution (Biol. 14)	2
		Elective	3 or 4
	19		19 or 20

SENIOR YEAR

General Entomology (Biol. 4)	4	Landscape Gardening (Hort. 6)	3
Systematic Pomology (Hort. 4)	3	Greenhouse Construction and Management (Hort. 5)	3
Commercial Fruit Growing Hort. 7)	3	Principles of Breeding (Agron. 7)	4
Plane Surveying (C. E. 1)	5	Sanitary Science (Vet. Sci. 6)	2
Thesis (Hort. 8)	2	Thesis (Hort. 8)	2
Elective	3	Elective	3 or 4
	20		17 or 18

Agronomy.

PROFESSOR ATKINSON.

MR. PATTERSON.

On the main floor of Agricultural Hall are the soil and grain laboratories and class rooms modern and thoroughly equipped.

The soil laboratory accommodating forty-eight students, provides for accurate work in soil physics and soil fertility. Upwards of two thousand dollars have been expended in equipping these laboratories with the most up-to-date fittings and apparatus, in order that the students may enjoy the very best facilities.

In the grain laboratory specially designed individual judging tables have been installed. This permits each student to pursue careful and continuous work in grain judging and enables him to become thoroughly familiar with the various grain standards. Vermin proof storage cases for class materials and standard samples have been provided. These insure the preservation of valuable material as accumulated. Score cards based on Montana conditions have been prepared for wheat, oats, barley and corn, and are used to impress students with the points to be looked for in grain-judging work.

A portion of the space in the greenhouses is given over to pot culture and germination work. Plots on the college farm are available for student work.

(1) **Field Crops.**—A study of grain crops, root crops, sugar, fibre and other classes of field crops which may be grown in Montana. The history, classification, management, uses and the possible manufactured products are fully discussed. In this course the students become familiar with the various commercial grain standards and have considerable grain judging practice with the score card. I, 5.

(2) **Soil Physics.**—This course is designed to prepare the students to understand better the effects of the different methods of treating soils, and the influence of these upon moisture, texture, aeration, fertility, and production. It comprises a review of the origin, formation and classification of soils and a study of the conditions influencing the supply of heat, air and moisture as related to growing plants. The work of the class room is supplemented by laboratory work comprising the determination of such questions as the water holding capacity and capillary power of various soils, and the effect of mulches and of various systems of rotation on the physical condition of the soil. Lectures 2; laboratory 3; I, 5.

(3) **Soil Fertility.**—Maintenance of fertility, fertilizers and rotation. The influence of barnyard manure, green manuring and commercial fertilizers upon the quality and yield of the various crops. The effects of different crops upon the fertility of the soil and upon succeeding crops, different rotations and the ultimate effect of different methods of farm

management upon the fertility and productive capacity of the soil, and also a study of the preservation of barn yard manure. II, 3.

(4) **Farm Mechanics:**—Includes the study of the development, construction, functions and methods of operating, adjusting and repairing implements and farm machinery; also a study of the principles of draft and the production of power, and the care and operation of such farm power machinery as the windmill, gasoline engine, and the different makes of traction plowing machinery. II, 3.

(5) **History of Agriculture.**—A study of the development of agriculture from the dawn of civilization, considering farming as carried on by the Greeks and Romans, through the middle ages, feudal farming, and the dawn of modern methods and practices in agriculture. II, 2.

(6) **Farm Management.**—This course considers the problems of farm management. The relative profits of different systems of farm management the relation of the industry of agriculture to other industries, and the social conditions of agriculture are considered. I, 4.

(7) **Principles of Breeding.**—This course considers the different theories of plant and animal improvement, and embraces a study of selection, heredity, variation, atavism, and fecundity; also cross breeding and in-and-in breeding, with a historical study of their results. II, 4.

(8) **Soil Management:**—This course includes a study of the most approved methods of handling various soils in their relation to crop production. It embraces a study of alkali, sandy, heavy clay, gumbo, muck, peat and old worn out soils, as well as a study of the management of irrigated and dry farm lands. II, 2.

(9) **Thesis.**—Agronomy students are required to prepare a graduating thesis on some subject to be approved by the head of the agronomy department. The subject of this thesis must be decided upon not later than November 15th, of the senior year, and the thesis must include considerable research and experimental work on the part of the student. I and II, 4.

Animal Industry and Dairying.

PROFESSOR CLARK.

MR. SCHOPPE

MR. GRIFFIN

MR. JONES

For the work in animal industry there is available a herd of thirty-five dairy cows, herds of pure bred cattle, Herefords, Shorthorns, Angus, Holsteins, Ayrshires, and Jerseys, Percheron horses, pure bred Berkshire, Poland China, and Yorkshire swine, and Shropshire, Rambouillet, and Cotswold sheep. During the winter season the live stock used in the feed-

ing experiments is also available for study. For the poultry work nine breeds of fowls are kept.

The cattle barn is a two-story frame building with two wings extending to the south. One of these wings is used for the dairy cows and breeding stock, and the other for bulls, young stock and calves. Between these two rooms is located a stock judging pavilion forty feet square. The second story of the main barn is used for the storage of hay. The first story provides feeding rooms, storage for grain, and box stalls.

The horse barn is a two story frame building with stalls for 20 horses, carriage and feed rooms, and capacity of 100 tons of hay.

The piggery consists of a main building thirty by thirty-five feet, with two wings sixteen by fifty feet each. In the main building are the feeding rooms and slaughter room, while the wings provide six pens each.

The poultry buildings include two main buildings, one seventy-two by sixteen feet, with twelve pens; the other one hundred and twenty-eight feet long with eight pens; with yards one hundred feet long on either side, and a brooder house, thirty-six by sixteen feet. These buildings are connected by a feed room, fourteen by twenty feet, under which is an incubator cellar and a heating plant for the building.

The dairy is equipped with all modern appliances for the manufacture of butter and cheese. Eight hand separators afford the students an opportunity to compare the merits and demerits of the different types.

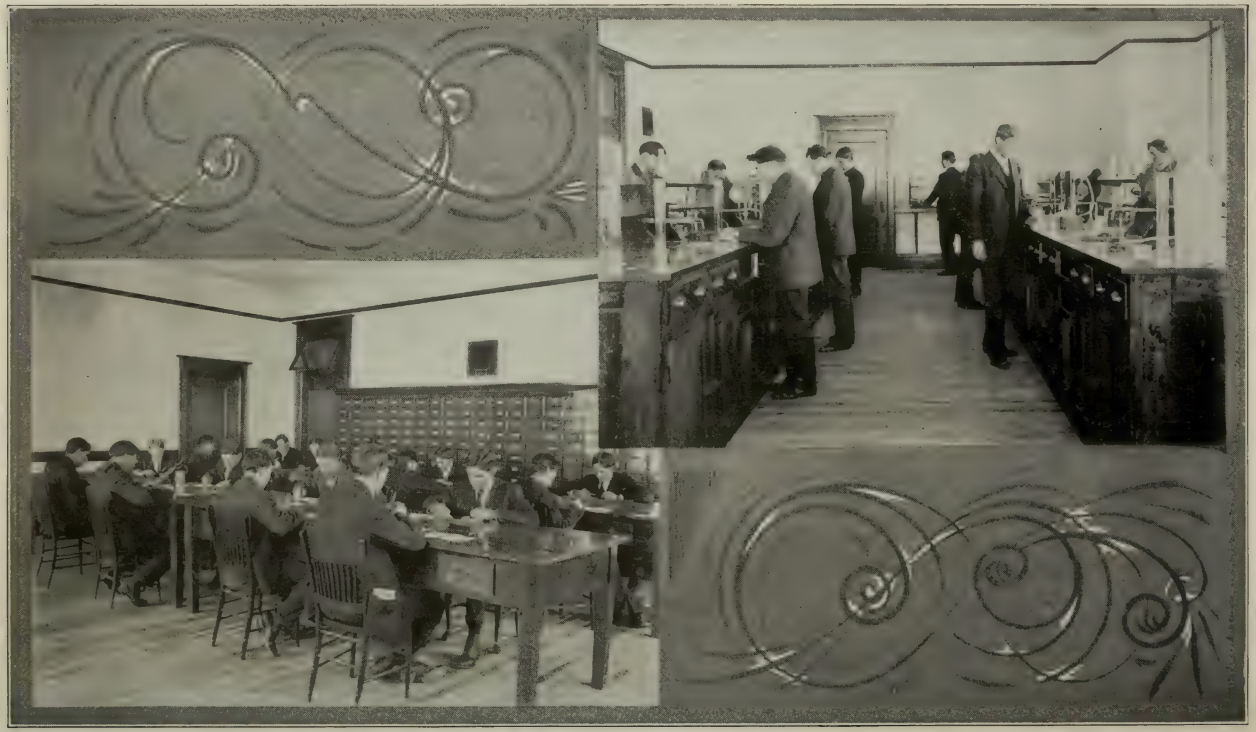
In churns there are the Perfection, Disbrow and Simplex. These are all combined churns and butter workers, yet are entirely different in style. In addition, the butter room is equipped with all modern appliances for handling milk and cream such as cream vats, tempering vats, Wizard and ensen ripeners, starter cans, and Bohn refrigerator together with all things necessary for the manufacture of butter in an up-to-date plant.

The creamery is equipped with a 5 horse power boiler and a 5 horse power electric motor, and in the practical work each student takes his turn in handling these machines.

The cheese room is 30 by 30 feet with curing rooms 20 by 20 feet; in the former there are cheese vats, gang and upright presses and all necessary hoops and equipment for the manufacture of all varieties of American Cheddar cheese. In this department there is made both Edam and Brick cheese, but especial emphasis is placed on the manufacture of the American cheese.

The testing laboratory is very thoroughly equipped with different styles of Babcock testers (both hand and steam) and all necessary glassware for the testing of milk, cream, butter, cheese, skim milk, whey, etc. Different tests for the determination of moisture in butter have been added as well as a complete equipment for acidimetry.

(1) **Animal Types.**—A study of types as related to production and work. This course covers the judging of the different market classes of



GRAIN LABORATORY.

SOIL LABORATORY.



TYPES OF CATTLE.

cattle, (beef and dairy), of sheep, (mutton and wool), of horses, (light and heavy), and of hogs, (bacon and fat). The entire time of this course is given to practical handling and judging of the stock in the stock pavilion. Laboratory 3; II, 3.

(2) **Breeds of Live Stock.**—A study of the development of the breeds of horses, cattle, swine, and sheep will illustrate the principles and particular characteristics, and distinguish one breed from another, and will show the adaptability of each particular breed to various climates, conditions, and purposes. These lectures will be illustrated by stereopticon views of characteristic animals of the different breeds. Lectures, 3; laboratory, 1. I, 4.

(3) **Stock Judging.**—Animal measurements and the systematic study of animal form, function, and performance; the aim being to give exact and intimate acquaintance with the detailed form of specialized types, a knowledge that is essential to the highest success in selection and breeding; also some systematic work in the judging of groups of cattle, horses, sheep and swine, similar to those found at county and state fairs. Lecture, 1; laboratory 1. I and II, 4.

(4) **Feeding Live Stock.**—The principles underlying the profitable feeding of animals. The composition of plants, animals and animal products. The practice that gives best results as indicated by available data gathered from the work of experiment stations in this and other countries. II, 3.

(5) **Herd Books and Pedigrees.**—This is largely a laboratory study of the herd books of different breeds of live stock. The tabulation of pedigrees and such other exercises as will enable the student to learn the pedigrees is practised, and such other exercises as will enable the student to learn the value of a pedigree and show how to keep the record of a breeding herd. I, 1.

(6) **Care and Management of Live Stock.**—A special study of the methods to be followed in the breeding, feeding and development of the various classes of live stock as illustrated from the practices of the most successful live stock breeders. I and II, 6.

(7) **Poultry.**—Breeds and management; poultry houses; feeding and care of poultry; the operation of incubators and brooders. II, 3.

(8) **Farm Dairying.**—This course comprises a study of the subject of dairying and its general relation to the farm. The class work takes up production of milk, separation of cream by gravity and separator; the preparation of starters; the ripening and churning of cream; the packing and marketing of butter. The use of the Babcock tester is also discussed with particular reference to its use on the farm; also the construction of the milk house and stables with regard to sanitary conditions as well as to utility. Lectures, 2; laboratory, 1. I, 3.

(9) **Milk and Milk Testing.**—This course comprises a study of milk,

its secretion, composition, and uses; pasteurization; separation and handling for city milk trade; the care of milk for creamery or cheese factory; the testing of variations and adulterations; the testing of butter and cheese; and the use of the acidimeter. Reference books used: "Milk and Milk Testing," by Farrington & Wall; "Modern Methods of Testing Milk and its products," by Van Slyke; and "Dairy Laboratory Guide," by Melick. Lectures, 2; Laboratory, 1. I, 3.

(10) **Dairy Manufactures.**—This course comprises advanced work in butter making, the scoring of butter and cheese, factory management and accounting, milk inspection, and the preparation of ice cream and ices.

This course is also intended to give the student a general knowledge of the different ways in which milk and its products are utilized outside of the scope ordinarily considered under dairying; such subjects as the preparation of condensed, certified, modified, and hygienic milk. Reference books used: "The Principles and Practices of Butter Making," by McKay and Larsen; and "Jensen's Milk Hygiene," by Pearson. Lectures, 1; laboratory, 3 II, 4

(11) **Cheese Making.**—The equipment for factory and home cheese making, the principles and practice necessary to make a uniform article and methods used to overcome characteristic difficulties are explained and illustrated in the class room and laboratory All common varieties of cheese, such as Cheddar, Swiss, Brick, and Limburger, are discussed, and as far as possible made in the cheese room, but the Cheddar cheese making is particularly emphasized. Reference books: "Cheese-making," by Decker; and "The Science and Practice of Cheese Making," by VanSlyke & Publow. Laboratory, 3. II, 3.

(12) **Thesis.**—During the senior year each student is required to prepare a thesis This must be original work by the student, who must consult with the instructor in charge regarding subject. I and II, 4.

Horticulture.

PROF. WHIPPLE.

(1) **Principles of Plant Culture.**—This course deals with the principles of plant culture, beginning with the germination of seeds; the selection and storing of seeds; the growth of plants as influenced by their environments; the physiology of the growth of plants; the functions of different parts of plants; methods of reproduction: the fruiting of plants as influenced by culture, etc.; the plant as affected by heat, cold, excessive water, light, lack of food, etc.; the principles and practice of propagation other than by seeds; transplanting; and the elements of pruning. The work is taken up in text book, lectures and practice work. II, 4.

(2) **Pomology.**—This course is designed for horticultural students, and deals with the principles and practice of pruning of tree-fruits, grapes and small fruits; the physiology of pruning; the fruit bearing habits of plants and their relation to pruning; the effect of ringing, bending and thinning fruit; pruning young trees, dwarf trees and mature trees—these subjects will be treated in text book, lectures and practice work. I, 3.

(3) **Vegetable Gardening and Small Fruit Culture.**—This course deals with the principles of vegetable gardening and small fruit culture, as well as with the practical side of the subjects. The growing of vegetables in the garden and greenhouse will be discussed. The growing of small fruits adapted to Montana conditions will be taken up in detail. The subjects will be treated in text book, lectures and practice work. II, 5.

(4) **Systematic Pomology.**—This course takes up the systematic side of pomology, the description and naming of varieties of fruit. Considerable time will also be devoted to the judging of exhibition fruit and discussions of score cards. The latter part of the course will be devoted to a study of the evolution of cultivated plants, especially fruits. Lectures, 2; laboratory, 1. I, 3.

(5) **Green House Construction and Management.**—The construction, heating and maintaining of greenhouses, with lectures and practice treating of the methods of growing plants in greenhouses and conservatories. II, 3.

(6) **Landscape Gardening.**—The laying out and planting of private and public grounds are discussed. The trees, shrubs and flowers suited to Montana conditions are studied. Lectures, 2; laboratory, 1. II, 3.

(7) **Commercial Fruit Growing.**—In this course the methods of planting, cultivating, irrigation and managing commercial orchards are discussed in the class room and orchard. The methods of picking, grading, packing and marketing fruits are important phases of the course. Lecture, 1; laboratory, 2. I, 3.

(8) **Thesis.**—Horticultural students are required to prepare a thesis during the senior year, two credits running throughout the year being allowed for this work. The subject of the thesis must be approved by the head of the horticultural department and must be decided upon not later than November 15th, of the senior year. I and II, 4.

Veterinary Science.

DR. TAYLOR.

(1) **Veterinary Physiology.**—A course in animal physiology dealing with the prehension of foods as observed in the various domestic animals. Also the digestion, assimilation and uses of the various foods, the circulation of the blood and its function, the nervous system, the sense of sight and the phenomenon of locomotion. Biology 3 prerequisite. Text book, "A Manual of Veterinary Physiology," by Captain F. Smith. I, 3.

(2) **Anatomy.**—Lectures and laboratory work dealing with the bony framework of the body and its muscles. Special emphasis is laid upon a thorough study of the thoracic and abdominal organs and organs of reproduction. Veterinary Science 1 prerequisite. Text book, Chauveau's Comparative Anatomy of the Domesticated Animals. II, 3.

(3) **Pathology.**—This course is designed to make the student familiar with the normal and pathological tissue. Gross and microscopical specimens will be used for demonstration. Course 2 in Veterinary Science prerequisite. II, 3.

(4) **Obstetrics**—Diseases of animals incident to reproduction. Emphasis will be put especially upon normal presentations and reduction of dystokia. Veterinary Science 2 prerequisite. Text book, Williams's Veterinary Obstetrics. I, 3.

(5) **Materia Medica.**—A comprehensive study of the combination of the more common drugs in the treatment of farm animals. Biology 9 prerequisite. I, 2.

(6) **Sanitary Science.**—This course deals with the care and handling of animals affected with communicable diseases. It will also include a few lectures upon sanitary police, on inter-state shipment, and on farm sanitation. Text book, Law's Veterinary Medicine, Vol. IV. II, 2.

(7) **Common Diseases of Animals.**—On the causes, prevention and treatment of the more common diseases of animals. II, 3.

Division of Engineering.

The purpose of the courses offered in the division of engineering is to furnish the student the fundamental training essential to a successful engineer. This result is accomplished, not alone by the study of the theoretical, but by giving attention to the practical application of the principles involved. A limited degree of flexibility is given in some of the courses through electives, thus enabling the student to specialize in any chosen line of work.

Candidates for engineering courses must be graduates from accredited high schools, or the college preparatory department, or pass equivalent examinations.

Courses are offered in civil engineering, electrical engineering and mechanical engineering leading respectively to the degree of Bachelor of Science in civil, electrical and mechanical engineering.

Civil Engineering.

This course is designed to give the student all of the fundamental studies necessary for the profession and at the same time especially qualify himself to best conduct the particular classes of engineering work most likely to be required in Montana.

Without overlooking the importance of a thorough knowledge of the fundamental principles of engineering, the course has been designed to overcome some of the difficulties encountered by the young engineer in entering the work of practical life. The aim is to supply the lack of understanding of practical rules and methods, for which so many college graduates are criticized by the general public and which so handicaps the student after graduation. Not only is the student taught with the idea of making him an efficient office assistant, but some instruction is given in practical estimates of cost of construction and such items as will enable him to appreciate the value and necessity of business and engineering methods, and possibly lead the way to engineering management and contracting.

Special care has been given to perfect the student, as far as possible in the branches of engineering work which promise the best in the future of this state; namely, road and railway engineering; sanitary engineering; irrigation engineering; hydraulics and water power development.

In order to enable the student to specialize, the course has been divided, after the sophomore year, into two branches, both of which lead to the degree of B. S. in civil engineering. One course enables the student to become proficient in irrigation engineering and the use of instruments; while the other specializes in those studies essential to the sanitary engineer. Both courses are equally strong in railway and structural work.

As far as possible, the student taking this course will be expected to engage in practical engineering work during the summer vacations, and to this end each student registering in the course will be assisted in securing such positions as he may be able to fill at the close of each year.

The equipment of the department is up-to-date and sufficiently large to meet all present requirements.

CIVIL ENGINEERING

FRESHMAN YEAR

First Semester.		Second Semester.	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Algebra (Math. 1)	5	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Descriptive Geometry (M. E. 3)	2
Public Speaking (Eng. 4)	1	Public Speaking (Eng. 4)	1
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
Elementary Drawing (C. E. 2)	3	Mechanical Drawing (M. E. 3a)	3
Joinery (M. E. 2)	2	Forge (M. E. 6)	2
Foundry (M. E. 4)	1	Military Drill	1
Military Drill	1		
	19		19

SOPHOMORE YEAR

English Composition (Eng. 1)	2	Calculus (Math. 4)	5
Calculus (Math. 4)	5	Electrical Machinery (E. E. 1)	2
General Physics (Phys. 1)	3	Cement Tests (C. E. 15)	1
Physical Measurements (Phys.2)	2	General Physics (Phys. 1)	3
Plane Surveying (C. E. 1)	5	Physical Measurements (Physics 2)	2
Photography (Chem. 4)	2	Railway Engineering (C. E. 4)	6
Military Drill	1	Military Drill	1
	20		20

JUNIOR YEAR.

Theoretical Mechanics (C. E. 5)	4	Applied Mechanics (C. E. 6)	4
Hydraulics (C. E. 8)	3	Strength of Materials (M. E. 14)	1
Seminar (C. E. 12)	1	Structural Engineering (C. E. 13)	6
Irrigation Engineering (C. E. 9)	3	Sanitary Eng. (C. E. 14)	3
*Field Practice (C. E. 11)	4	Seminar (C. E. 12)	1
*Least Squares (Math. 5)	2	*Light and Sound (Phys. 3)	2
*Cost of Construction (C. E. 25)	2	*Geology (Geol. 1)	3
**Biology (Biology 9)	5	**Organic Chemistry (Chem. 5)	5
**Qualitative Analysis (Chem. 2)	4		
	19 or 20		20

SENIOR YEAR

Economics (Econ. 3)	2	Economics (Econ. 3)	2
*Geodetic Surveying (C. E. 17)	2	Contracts and Specifications (C. E 23)	3
Water Power Development (C. E. 18)	3	Municipal Engineering (C. E. 3)	3
Engineering Design (C. E. 19)	3	Engineering Design (C. E. 19)	3
Seminar (C. E. 12)	1	Seminar (C. E. 12)	1
Foundations and Masonry (C. E. 21)	3	*Practical Astronomy (C. E. 24)	2
*Field Practice (C. E. 20)	2	**Water and Air Analysis (Chem. 10)	2
*Astronomy (Math. 6)	3	Thesis (C. E. 27)	5
**Bacteriology (Biol. 12)	5		
**Qualitative Analysis (Chem. 3)	4		
	19 or 21		19

*Required in the regular course only.

**Required in the sanitary engineering course only.

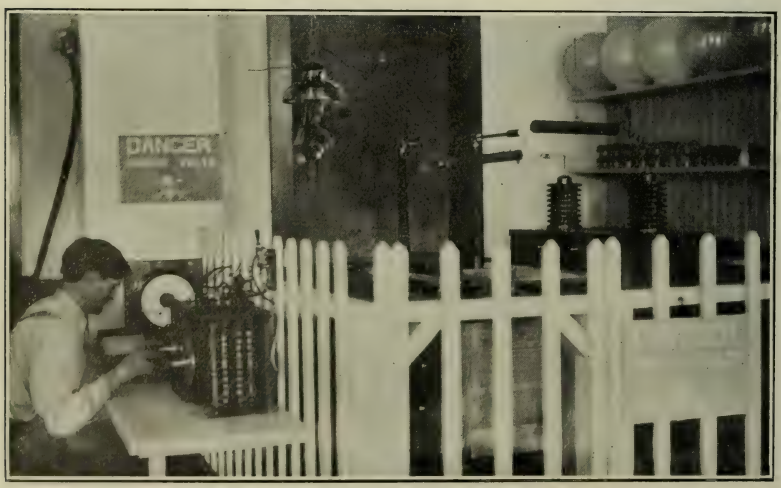
Electrical Engineering.

This course provides a thorough technical training in electrical engineering. The rapid development of electrical engineering is largely due to the use of sound theory in the solution of commercial problems. For this reason the theoretical subjects, and the application of theory to the solution of practical problems are emphasized.

The course is designed to teach students the scientific laws and principles forming the basis of the profession, and the application of these laws and principles to commercial problems. The general training consists of courses in mathematics, physics, chemistry, drawing and shop work. The electro-technical work consists of lectures and recitations on the theory of electrical phenomena, and on problems in the design, construction and operation of electrical machines and apparatus. Conventional methods are used in drawing and designing, and the experimental tests made in the laboratory are essentially similar to the tests made by large manufacturing companies. The apparatus and instruments used are of modern commercial types.

A limited number of electives is offered during the sophomore, junior, and senior years. Students may choose their electives by consultation with the head of the department.

The course is supplemented by an annual inspection trip to some of the large power plants of Montana, and by lectures by prominent electrical engineers.

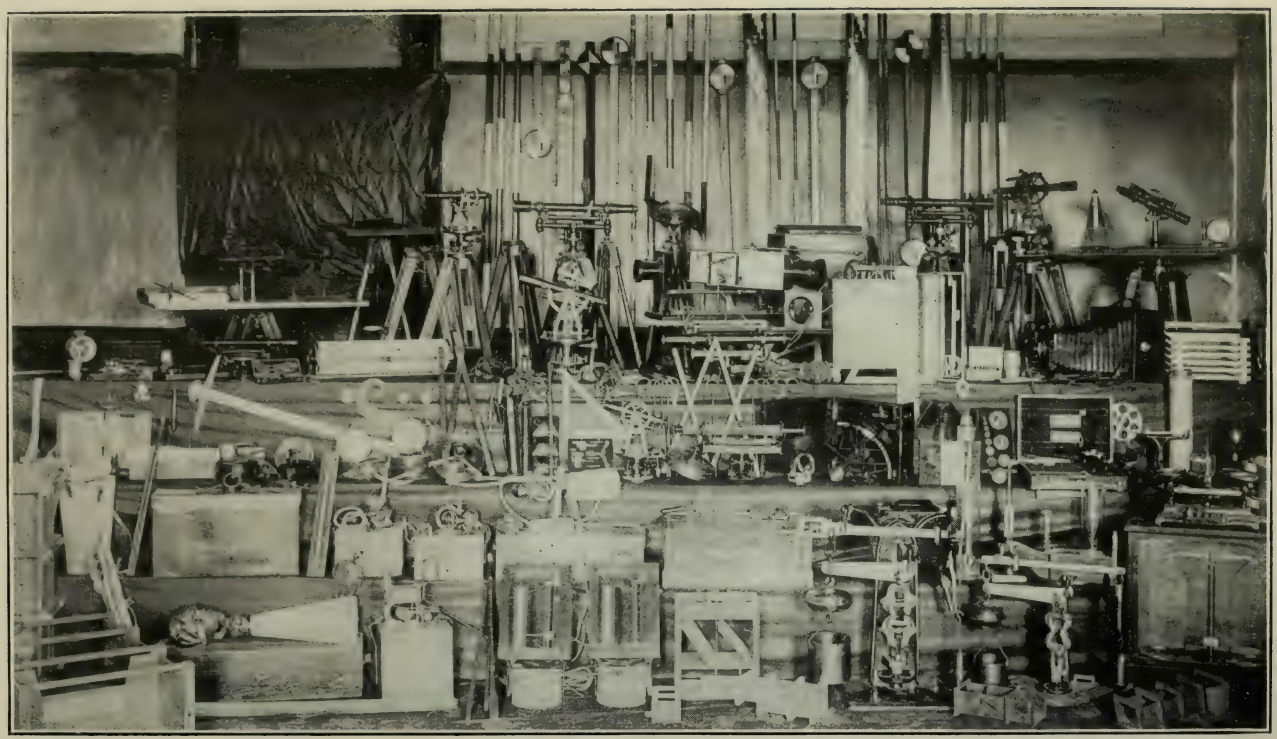


150,000 Volt Transformer.



ELECTRIC CLUB.

CIVIL ENGINEERING SOCIETY.



CIVIL ENGINEERING.

ELECTRICAL ENGINEERING.

FRESHMAN YEAR

First Semester.		Second Semester.	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Algebra (Math. 1)	3	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Descriptive Geometry (M. E. 3)	2
Public Speaking (Eng. 4)	1	Public Speaking (Eng. 4)	1
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
Elementary Drawing (E. E. 21)	3	Mechanical Drawing (M. E. 3a)	3
Joinery (M. E. 2)	2	Forge (M. E. 6)	2
Foundry (M. E. 4)	1	Military Drill	1
Military Drill	1		
	19		19

SOPHOMORE YEAR

Expository Composition (Eng. 2)	2	Calculus (Math. 4)	5
Calculus (Math. 4)	5	General Physics (Phys. 1)	3
General Physics (Phys. 1)	3	Physical Measurements (Phys.2)	2
Physical Measurements (Phys. 2)	2	Electrical Machinery (E. E. 1)	2
Forge Work (M. E. 9)	2	Dynamo Drawing (E. E. 2)	2
Military Drill	1	Military Drill	1
Elective	3 to 5	Elective	2 to 4
	18 to 20		17 to 19

JUNIOR YEAR.

Theoretical Mechanics (C. E. 5)	4	Applied Mechanics (C. E. 6)	4
Applied Electricity (E. E. 3)	3	Dynamos and Motors (E. E. 5)	4
Electricity and Mag. (Phys. 5)	2	Dynamo Design (E. E. 8)	3
Electrical Measurements (Phys. 6)	2	Strength of Materials (M. E. 14)	1
Electrical Diagrams (E. E. 7)	2	Dynamo Testing (E. E. 6)	2
Electrical Lab. (E. E. 4)	2	Seminar (E. E. 17)	1
Seminar (E. E. 17)	1	Elective	2 to 4
Elective	2 or 3		
	18 or 19		17 to 19

SENIOR YEAR

Economics (Econ. 3)	2	Economics (Econ. 3)	2
Alternating Currents (E. E. 9)	4	Alternating Currents (E. E. 11)	4
Transformer Design (E. E. 13)	3	Alternator Design (E. E. 16)	3
Power Plant Practice (M. E. 16)	1	Contracts and Specifications (E. E. 14)	1
Single Phase Testing (E. E. 10)	3	Polyphase Testing (E. E. 12)	2
Seminar (E. E. 17)	1	Seminar (E. E. 17)	1
Thesis (E. E. 20)	2	Thesis (E. E. 20)	3
Elective	2 or 3	Elective	2 or 3
	18 or 19		18 or 19

Mechanical Engineering.

The purpose of the course in mechanical engineering is to fit its graduates for successfully filling responsible positions as supervising and designing engineers. It prepares for the design, construction and installation of machinery, steam and gas engines, shop, laboratory and power plant equipment, and for the design, superintendence and management of power plants and manufacturing establishments.

The course comprises four years' instruction and training by text book, lecture, laboratory and shop practice, based on mathematics, physics, chemistry, pure and applied mechanics, machine design, structural design and thermodynamics. It is designed to give the student a thorough knowledge of the basic principles of his profession and such technical skill as the application of theoretical principles in every-day practice in shop and laboratory will insure. The work of each department,—class room, laboratory, shop and designing room,—is made to supplement the work of each of the others, thus giving a balance in the technical equipment of the young engineer obtainable in no other way.

MECHANICAL ENGINEERING

FRESHMAN YEAR

First Semester.		Second Semester.	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Algebra (Math. 1)	3	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Descriptive Geometry (M. E. 3)	2
Public Speaking (1)	1	Public Speaking (1)	1
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
Mechanical Drawing (M. E. 1)	3	Mechanical Drawing (M. E. 3a)	3
Joinery (M. E. 2)	2	Forge Work (M. E. 6)	2
Foundry (M. E. 4)	1	Military Drill	1
Military Drill	1		
	19		19

SOPHOMORE YEAR

Calculus (Math. 4)	5	Calculus (Math. 4)	5
Expository Composition (Eng. 2)	2	Steam Engines and Boilers (M. E. 7)	4
General Physics (Phys. 1)	3	General Physics (Phys. 1)	3
Physical Measurements (Phys. 2)	2	Physical Measurements (Phys. 1)	2
Kinematics (M. E. 5)	3	Kinematics (M. E. 8)	2
Mechanical Drawing (M. E. 5a)	2	Mechanical Drawing (M. E. 8a)	1
Forge Work (M. E. 9)	2	Foundry (M. E. 30)	1
Military Drill	1	Pattern Work (M. E. 4a)	1
		Military Drill	1
	20		20

JUNIOR YEAR.

Theoretical Mechanics (C. E. 5)	4	Applied Mechanics (C. E. 6)	4
Elect. and Magnetism (Phys. 5)	2	Machine Design (M. E. 13)	3
Elect. Measurements (Phys. 6)	2	Engineering Laboratory (M. E. 14)	1
Valve Gears (M. E. 15)	2	Dynamos and Motors (E. E. 5)	4
Engineering Laboratory (M. E. 15a)	1	Dynamo Testing (E. E. 6)	2
Hydraulics (C. E. 8)	3	Mechanical Drawing (E. E. 13a)	2
Mechanical Drawing (M. E. 10)	3	Machine Work (M. E. 21)	2
Machine Work (M. E. 17)	2	Cement Tests (C. E. 15)	1
		Seminar (M. E. 11)	1
	19		20

SENIOR YEAR

Economics (Econ. 3)	2	Economics (Econ. 3)	2
Thermodynamics (M. E. 18)	5	Thermodynamics (M. E. 22)	3
Boiler Design (M. E. 19)	3	Engine Design (M. E. 23)	2
Mechanical Drawing (M. E. 19a)	2	Engineering Laboratory (M. E. 28)	2
Eng'ng Laboratory (M. E. 20)	3	Power Plant Design (M. E. 29)	3
Machine Work (M. E. 27)	2	Industrial Organization (M. E. 25)	2
Seminar (M. E. 11)	1	Seminar (M. E. 11)	1
Thesis	1	Thesis	3
	19		18

CIVIL ENGINEERING

PROF KNEALE

ASST. PROF. SNOW

The equipment of this department consists of 4 transits, 2 with solar attachments; precision level; four engineers' levels: 3 plane tables with alidades and declinators; one sextant; artificial horizon; one reflectoscope; two engineers' aneroid barometers; one engineers' compass; clinometer; one hand level; one stadia hand level; one Burton's transit; five current meters; three automatic water registers; one Fairbanks' briquette testing machine with briquette molds, etc.; two vicat needles; one fineness scale; one set assay balances; one odometer; one specific gravity apparatus; one weir measuring device; one adjustable weir; one set of railway curves; one rolling planimeter; 2 polar planimeters; level and stadia rods; chains, tapes and pins; calculating instruments, etc.

In addition to the above the department is supplied with a good office equipment in the way of draughting instruments, scales, T-squares, straight edges, etc.

A very complete cement testing laboratory has been added to the department and students are enabled to specially qualify along this line of engineering.

The quarters of the department are in the second story of the main building and consist of two recitation rooms, one large draughting room, one seminar room, and the office. The draughting room is well supplied with desks and draught-boards, also a traveling blue print frame capable of printing drawings 36x52 inches. A suitable dark room and apparatus for teaching photography and the methods of making and printing blue-process papers forms a part of the equipment.

(1) **Plane Surveying.**—The theory and practice of plane surveying, including the elementary principles, the use and adjustment of field and office instruments, the methods of field, topographic, hydrographic, mine and city surveying; barometric and spirit leveling, and the computation of earth work. Prerequisites, mathematics up to and including trigonometry. Texts, Theory and Practice of Surveying by Johnston, Manual of Surveying by Pence & Ketchum. Lectures, 3; laboratory, 2. I, 5.

(2) **Elementary Drawing.**—This course is designed to teach the student the use of draughting instruments in topography, projection, isometric drawing, mapping, sketching and lettering; the principles of perspective; and tracing and blue printing. Owing to the demand for topographical draughtsmen the course has been extended through the second semester for all students desiring to become especially proficient, and is elective to all students completing the first semester's work. Laboratory, 3. I.

(3) **Municipal Engineering.**—This course is designed especially to qualify the engineer along the lines of highway construction, both city

and county. Different surface materials, influence of grades, forms of gutters, culverts, curbing, etc., are carefully studied. This course is especially designed to meet the requirements of the municipal engineer. Prerequisites, C. E. 1, 2 and 4. Baker's Roads and Pavements. Lectures, 3. II.

(4) **Railroad Engineering.**—Railroad reconnoisance, preliminary and location surveys. Theory and practice in laying out railroad structures, simple and compound curves, easements and transition spirals, simple and compensated grades, switches, turnouts and crossings. Cost of railroad construction including the simpler structures in steel, concrete and timber. The making and use of mass diagrams, profiles, field maps, cross sections, etc. Calculations of yardage in embankments, excavations and borrow pits. Complete map of location survey for short line of railroad. Prerequisite, C. E. 1. Texts, Searles' Field Engineering, Webb's Railroad Construction. Lectures, 4; laboratory, 2. II, 6.

(5) **Theoretical Mechanics**—Kinematics, Newton's laws of motion, dynamics of a particle, statics, friction, work and energy, dynamics of rotation, graphical and analytical methods employed. Text, Maurer's Technical Mechanics. Prerequisites, mathematics, including calculus, physics 1 and 2. Lectures, 4. I.

(6) **Applied Mechanics**—Resistance and elasticity of materials, shear, tension, compression, working stresses, design of riveted joints in pipes and cylinders, stresses in simple and cantilever beams, investigation and design of columns, torsion in shafting for transmitting power, resilience of materials. Text, Merriman's Mechanics of Materials. Prerequisites, C. E. 5, Physics 1 and 2. Lectures, 4. II.

(8) **Hydraulics.**—Theoretical hydraulics; hydraulic measurements; flow of water through orifices, over weirs, through pipes, conduits, and canals. Text, Merriman's Hydraulics. Prerequisites, mathematics to and including calculus, physics 1 and 2. Lectures, 3. I.

(9) **Irrigation Engineering**—This course includes a study of the principles of impounding, diverting, conveying and measuring water; a study of the structures required in irrigation systems such as flumes, siphons, head gates, weirs, diversion works, and the various types of dams; a study of the problems of seepage and drainage in their relation to irrigation and reclamation; a sufficient study of steam, gasolene and wind driven pumps, and of pump types, to enable the student to select the most efficient device for raising water for service in irrigation. The problems of cost are also taken up. Prerequisites C. E. 1 and C. E. 4. Hydraulics must be taken in connection with the subject. Text, Irrigation Engineering, by Wilson. Lectures, 3. I.

(11) **Field Practice.**—Practice in the use of engineering instruments on the more difficult problems of civil engineering. The work is designed to develop speed and accuracy. The practical application of photography

to surveys and to reports is given considerable attention. Prerequisites, C. E. 1 and 4; and Chem. Laboratory, 4. I.

(12) **Seminar.**—In this course the student is required to deliver a lecture on an engineering topic; after the lecture the meeting is thrown open for general discussion. Each week a student is selected, by the professor in attendance, to preside at the meeting. The object of the course is to familiarize the student with recent engineering works, to assist in English composition and public speaking, and to point out the essential features of engineering articles. By means of the reflectoscope, which forms a part of the department's equipment, the student is enabled to give illustrated lectures. Lectures, 1. I and II, 4.

(13) **Structural Engineering.**—Theory and practice in the analytic and graphic calculation of stresses in simple structures. The structures studied will include the principle types of railroad and highway bridges; roof trusses, steel buildings; trestles; standpipes; reinforced concrete, etc. The laboratory periods are given to the preparation of complete working drawings and erection sheets for as many typical structures as possible. Prerequisites, C. E. 5 and 6. Text, Roofs and Bridges, part II, Merriman & Jacoby. Reference text, Theory of Modern Framed Structures, by Johnson, Bryan & Turneaure Lectures, 2. Laboratory, 4. II, 6.

(14) **Sanitary Engineering.**—Collection, purification and distribution of water; systems of water supply and sewerage; disposal of sewerage; house drainage; sanitary inspection. Text, Folwell's Sewerage, and Turneaure & Russell's Water Supplies. Prerequisites, C. E. 4, 5, 6, 8 and 9. Lectures, 3, II.

(15) **Cement Tests**—Study of physical properties of cement. Testing the various natural and hydraulic cements under varying conditions and mixtures. Text, Taylor's Cement Testing. Lectures, ½; laboratory, ½. II, 1.

(17) **Geodetic Surveying.**—Elements of geodesy. Base line measurements, triangulation, determination of true meridian and latitude. Regular senior study of C. E. course. Text, Breed & Hosmer's Higher Surveying. Lectures, 2. I.

(18) **Water Power Development**—A course in the development of water power. The design and use of the turbine, impulse and other forms of water motors. The design and construction of headraces, spillways, etc. The class will be required, whenever possible, to examine water powers, and report upon the design and method of development. Considerable time will be devoted to the description of recently installed plants as published in the engineering journals. Text, Merriman's Hydraulics, Reference, Church's Hydraulic Motors. Prerequisites, C. E. 1, 5, 6, 8. Lectures, 3. I.

(19) **Engineering Design.**—This course is devoted to the design of

engineering works, maps, etc. Regular study in C. E. course. Laboratory, 6. I. II.

(20) **Field Practice.**—This course is designed to give practice in the most advanced surveying. Where the nature of the thesis is such as to require advanced surveying, or laboratory investigation, this period may, at the discretion of the class officer, be used to assist in preparation of the thesis. Laboratory, 2. I.

(21) **Foundations and Masonry.**—This course includes a study of materials and methods employed in the construction of piers, abutments, masonry dams, and retaining walls; economy of construction, strength of joined materials; composition of different kinds of mortar; reinforced concrete construction. Text, Baker's Foundations and Masonry. Regular in C. F. course. Lectures, 3. 1.

(23) **Contracts and Specifications**—The elementary law of contracts and its application to engineering considered, together with the correct form of specifications and the judicial interpretation placed on the technical terms commonly used in engineering specifications Text, Johnson's Contracts and Specifications. Elective to all engineering students after the sophomore year. Lectures, 3. II.

(24) **Practical Astronomy.**—A short course in astronomy designed especially for the civil engineering students and to supplement the astronomy of mathematics. A considerable portion of the time in this course will be given to night work in taking observations on the circum-polar stars, and a part of the time to the solar observations. Text, Comstock's Field Astronomy for Beginners. Prerequisite, mathematics,6. Laboratory, 2. II.

(25) **Cost of Construction.**—This course is designed to acquaint the student with the cost of labor and materials used in engineering construction; to point out the necessity and methods of keeping accurate records of the cost of proposed engineering surveys, and construction work. Text, Gillette's Cost Data. Prerequisites, C. E. 1, 1a, 4, 5, 6, 8, 13 and 13a. Lectures, 2. I.

(27) **Thesis**—The student will be required before graduation to present a suitable thesis upon some engineering subject in the line of his course A copy of the same, together with all original maps, tables, etc., typewritten ,bound, and upon specified paper, will be filed with the college and become its property. The student is required to select his subject at the beginning of the senior year. 5, II.

ELECTRICAL ENGINEERING.

PROF. THALER

MR. PETERS.

The electrical engineering department occupies a two story stone building, 36x52 feet. The first floor contains the dynamo laboratory, the machines for testing the strength of materials and two steam engines. The second floor contains a class and drafting room, an arc light room, a battery room, a photometer room, and an office. Steam and electrical power are obtained from the main power house.

The equipment of the electrical laboratory is very complete, with apparatus of modern type. There are two double current multipolar generators, capacity 15 K. W. These machines may be driven by the 40 H. P. engine or by the laboratory motor, and may be used as direct current dynamos, as alternators, single, two or three phase as synchronous motors or as rotary converters.

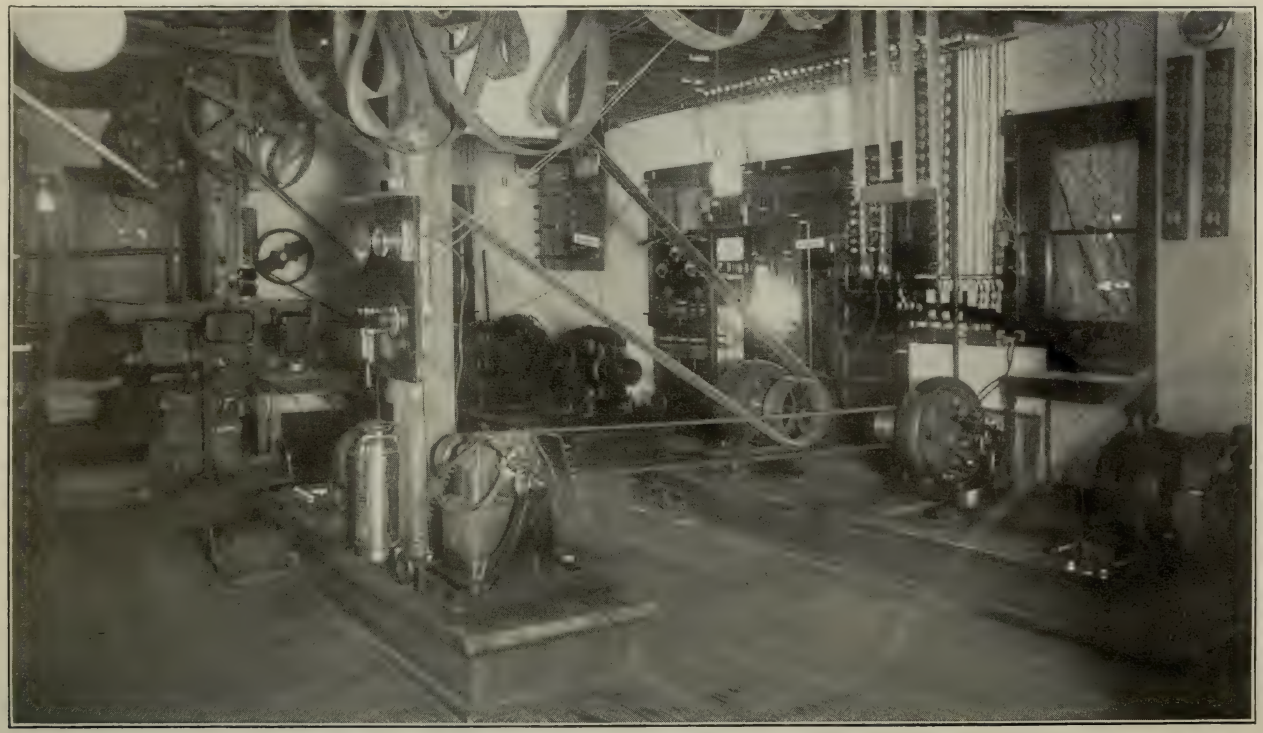
The two machines are also used for practice in synchronizing, and furnish alternating current for the induction motors, and for the mercury arc rectifier. For direct current work the laboratory contains in addition to the two generators, one Excelsior 15 light arc dynamo, connected to eight series-arc-lamps, arranged for testing purposes, one 15 H. P. Northern Electric Co. motor, one 10 H. P. Siemens and Halske motor and one 16 H. P. Western Electric Co. bipolar motor. Each motor is provided with a friction brake and other auxiliary apparatus for complete tests of the armature and field resistances of the magnetic distribution and leakage, and of the efficiency and regulation at different loads; one 6 K. W. Excelsior dynamo may be used as either a shunt or a compound machine and is driven by the 10 H. P. motor and arranged for testing purposes.

For alternating current work the laboratory contains, in addition to the two generators, one mercury arc rectifier, capacity 30 amperes at 110 volts; one 2 H. P. single phase Westinghouse induction motor with phase splitter, provided with a pony friction brake for efficiency and regulation tests at different frequencies and at different voltages; one 6 H. P. three phase General Electric Co. induction motor, also provided with auxiliary apparatus for testing purposes.

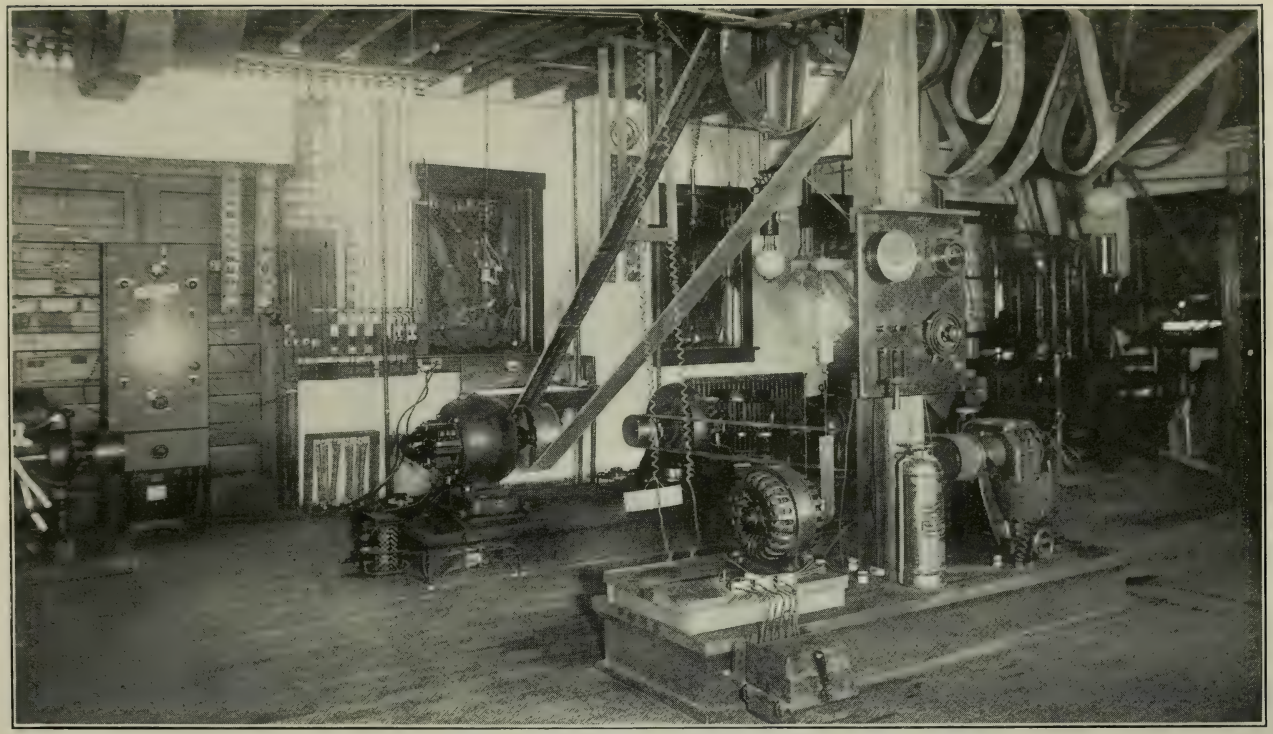
A 150,000 volt testing transformer is used to test insulators for high tension transmission, and to test the insulation resistance of insulating materials.

There are six transformers, with capacities from 1 to 1½ K. W. and with different ratios. The transformers are arranged for testing the core losses, the copper losses, and the efficiency and regulation at various frequences and voltages. They are also used for practice in transformer connecting for different purposes.

A General Electric Co. Oscillograph, with photometric and tracing



ELECTRICAL LABORATORY.



ELECTRICAL LABORATORY.

table attachments, is provided for investigating the wave forms of alternating and oscillatory electro-motive forces and currents.

For general testing the laboratory contains one stationary lamp bank of 136 incandescent lamps, with a current capacity of 130 amperes at 110 volts; the lamps are arranged so that the current can be regulated within a small fraction of one ampere; four portable lamp banks of ten lamps each, arranged so that the lamps can be connected either in series or in parallel; one 900 Ohm iron wire resistance and five iron wire resistances for heavy currents, besides a number of rheostats, switches and current breakers.

The laboratory contains twenty-nine electrical measuring instruments, including nine voltmeters; one Whitney 150-300 volts; one Whitney 15 volts; one Weston 150 volts; one Weston milli-voltmeter; one Weston 75-150 volt A. C.; one Westinghouse 150 volts switchboard voltmeter.

There are eight portable ammeters; one 5 ampere D. C. Weston, three Whitney ammeters, capacity 10, 25 and 50 amperes, D. C., respectively; two Hoyt's A. C. ammeters, 10 and 30 amperes respectively; one G. E. ammeter with series transformer, 120 amperes A. C.; and one Westinghouse ammeter, 120 amperes.

The department has four portable wattmeters; one Westinghouse, with series transformer, capacity 100 amperes at 200 volts; one Hoyt, capacity 1500 K. W.; one Weston, with multiplier, 2 amperes at 2250 volts; one G. E. Co. wattmeter, capacity 10,000 watts.

There is one Leeds potentiometer with standard cell and standard resistances for calibrating instruments; one Kelvin standard balance for calibrating watt meters; one Weston portable galvonometer; one Jacobi testing set for measuring resistances; and four integrating watt meters, potential arc lamps of different types, arranged for testing.

The arc light room contains eight series-arc-lamps and five constant potential ac lamps of different types, arranged for testing.

In the photometer room is a Willyoung station photometer with universal rotator and bunsen screen for testing the candle power, distribution of light, and the efficiency of incandescent lamps.

The battery room contains a storage battery of 56 cells at 60 ampere hours capacity, of the following types: 10 chloride accumulators, 10 National Battery Co.'s unit accumulator, 10 Willard cells and 10 American cells. The batteries furnish current for calibrating instruments and are also available for testing purposes.

In the office is a 700-candle power Cooper-Hewitt mercury vapor lamp apparatus for calibrating instruments and wireless telegraph apparatus.

(1) **Electrical Machinery.**—Lectures on the construction, care and operation of commercial electrical machines and apparatus, including batteries, electric lights, dynamos, motors, alternators, transformers and electrical

measuring instruments. Text book. Introduction to Electrical Engineering by H. H. Norris. Lectures, 2. II.

(2) **Dynamo Drawing.**—Detail working drawing, tracing, and blue printing of electrical machines in the laboratory, to familiarize the student with the conventional methods of representing the different parts of dynamos and motors. Laboratory, 2. II.

(3) **Applied Electricity.**—Methods and calculations of wiring, theory of primary cells and storage batteries, electric light and electrical measuring instruments. Prerequisites, calculus and physics (1). Textbook, Elements of Electrical Engineering, by Franklin & Esty. Lectures, 3. I.

(4) **Electrical Laboratory.**—Tracing circuits and wiring, calibrating instruments, efficiency tests of storage batteries, and the candle power of incandescent lamps. Prerequisites, physics (2). Textbook, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. I.

(5) **Dynamos and Motors.**—Principles of electro-magnetism, theory of dynamo electric machines, the design, construction and regulation of direct current dynamos and motors. Prerequisites, physics (1) and calculus. Textbook, Elements of Electrical Engineering, by Franklin and Esty. Lectures, 4. II.

(6) **Dynamo Testing.**—Laboratory tests to determine armature and field resistance, magnetic leakage coefficients, characteristic curves and the efficiency and regulation of various types of direct current machines. Prerequisites, physics (2) and (6). Textbook, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. II.

(7) **Electrical Diagrams.**—Conventional methods of representing electrical wiring and appliances. Drawings and wiring diagrams of the switchboards in the laboratory and in the power house and diagrams of the wiring of the college buildings. Laboratory, 4. I.

(8) **Dynamo Design.**—Problems in designing electro-magnets, dynamos and motors. Complete working drawings and specifications to accompany each design. Prerequisite, dynamo drawing. Reference, Design of Dynamos, by S. P. Thompson. Laboratory, 3. II.

(9) **Alternating Currents.**—Theory of alternating currents, properties of alternating current circuits, principles of alternators, transformers, rotary converters and induction motors, methods of testing alternating current apparatus. Prerequisites, physics (5). Text book, Alternating Current Machines, by Sheldon, Mason & Hansmann. Lectures, 4. I.

(10) **Single Phase Testing.**—Laboratory tests of single phase alternating current gererators, motors and transformers, calibration of alternating current measuring instruments and meters. Prerequisite, physics (6). Text book, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 3. I.

(11) **Alternating Currents.**—Development of the symbolic method of

Steinmetz, the solution of problems in transformer design and calculation of transmission line by the use of the algebra of complex numbers and by vector diagrams. Prerequisites, alternating currents (9). Text book, Alternating Current Phenomena, by Steinmetz. Lectures, 4. II.

(12) **Polyphase Testing.**—Laboratory tests of polyphase alternating current apparatus, including generators, motors, transformers and converters. Efficiency and regulation tests of a mercury arc rectifier, connection of transformers for transforming from three phase to two phase. Prerequisite, alternating current testing. Text book, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. II.

(13) **Transformer Design.**—Design and drawing of transformers to conform with certain specifications of efficiency and regulation. Calculation of the cost of the transformer. Open to students taking E. E. 9 and 11. Laboratory, 3. I.

(14) **Contracts and Specifications**—The law of contracts and its application to engineering contracts. Students are required to make specifications for estimates on proposed power plants, transmission lines or electrical apparatus. Text book, Contracts and Specifications, by Johnson, and Electrical Lighting Specifications, by Merrill. Lectures,1. II.

(16) **Alternator Design.**—Problems in designing alternators, converters and induction motors. Design and specifications of alternating current circuits. Prerequisites, alternating currents (9). Laboratory, 3. II.

(17) **Seminar**—Weekly meeting for the purpose of discussing current electrical engineering literature. Lectures, 1. I and II, 4.

(18) **Special Design.**—Design and construction of some special electrical apparatus or machine. Elective for seniors. Laboratory, 3. I or II.

(20) **Thesis.**—Before graduating each student must present a suitable thesis upon some engineering subject in line with his course. One copy of the thesis will be filed in the college library as the property of the college. The subject for the thesis must be chosen at the beginning of the senior year. 5. I and II.

(21) **Elementary Drawing.**—Plain lettering, the use of instruments, geometrical problems, orthographic, isometric, and cabinet projections of simple objects. Laboratory, 3. I.

Mechanical Engineering.

PROFESSOR DEARBORN.
ASSISTANT PROFESSOR CARLSON.
MR. CHALLENDER.
MR. KATELEY.
MR. PARK.

The facilities provided for the instruction and practice in the department of mechanical engineering include class rooms, drawing room and office, occupying the south half of the basement of the Main building, wood shop, forge shop, iron and brass foundry, machine shop, office and reading room in the shop building, steam and material testing laboratory in the engineering laboratory, and the power plant of the college.

The drawing room is furnished with desks and drawers for one hundred and twenty-four students, and with numerous models, machine parts, and blue prints of trade machinery. The equipment includes also demonstration apparatus, blue print facilities, beam compasses, protractors, odontograph and universal drafting machine. The work in drawing and design is carried on in such a way as to bring out its relation to the subsequent work in the shops, sound commercial practice being emphasized.

The material testing laboratory equipment includes a Riehle 100,000 pound testing machine, both automatic and autographic, with extensometer for tension and compression tests, and deflectometer for transverse tests; an Olsen torsion machine for specimens having a cross section up to one and one-fourth inches square; also micrometers, surface plate and gage with micrometer indicator for testing parallelism, calipers, scales, etc.

The equipment available for steam and gas engine tests comprises in part the following: A 7x7 in. vertical steam engine with eccentric adjustable; an 8x12 in. automatic cut-off Woodbury engine, with water cooled brake wheel, connected up with a 50 H. P. Dean Bros. surface condenser and arranged to run condensing or non-condensing, and with or without live or exhaust steam in the cylinder jacket; an 11x12 in. automatic cut-off Lycoming engine direct-connected to a 40 K. W. direct current generator, furnishing light and power for the college; two small gasoline engines; all necessary brakes, generators and lamp banks for loading the engines, scales, meters, tanks, etc. In addition there are planimeters, separating and throttling calorimeters, thermometers, one Tabor (outside spring) indicator, one Thompson indicator, one set Crosby indicators, with electro-magnetic device for taking simultaneous cards, standard pressure gages, apparatus for testing gages and indicator springs under steam pressure and a Crosby oil pressure gage testing outfit.

A one-hundred-twenty-five horse-power Root water tube boiler, an eighty horse-power horizontal multi-tubular boiler, an Advance compound traction engine, together with pumps, injectors, feed water heaters, fans,

etc., and the station heating plant, furnish extensive facilities for the investigation of problems related to power production, heating and ventilation.

The shops are equipped with standard machinery and tools for working wood and metal. This equipment is being added to as needed, largely by manufacture in the shops by the students, under the supervision of competent foremen.

The wood shop measures 36x50 feet and is furnished with modern wood-working machinery, including a 20 inch Fay planer, a 14 inch circular pattern saw, a 36 inch band saw, a Fay universal jointer, a Fay and Egan friezer, a jig saw, foot mortiser, trimmer, a 16 inch pattern lathe, seven 10 inch lathes with turning-tools for thirty-six students, and seventy-two complete sets of carpenters tools, with benches for joinery, house carpentry, pattern work and cabinet work.

The forge shop is 28x60 feet and contains nineteen down draft power forges with Sturtevant blowers, a 50-lb. power hammer, shear, and a full equipment of anvils and small tools. In the work here a graded series of exercises leads the student from simple drawing and upsetting to size, to complex forging and tool making, hardening and tempering, all the work being done from working drawings.

The foundry, 30x48 feet, is equipped with a No. 1 Whiting cupola having a melting capacity of one ton of iron per hour, a brass furnace, core oven, crucibles, flasks and patterns. The work comprises bench and floor molding, cupola and brass furnace practice, the product consisting of castings of machine parts, test bars, brass, bronze and other alloys for bearing metal, ornamental pieces, etc.

The machine shop measures 60x72 feet, and adjoining it are the tool room, stock room, office, lavatory and locker room. The equipment includes an 18 inch Davis and Egan, a 16 inch LeBlond and three 16 inch Flather engine lathes, a 22 inch Flather planer, a 16 inch Davis and Egan shaper, a Gisholt tool grinder, a 28 inch Cincinnati drill, a 20 inch Prentice drill, a 14 inch sensitive drill, a 24 inch Barnes grinder, a 6 inch pipe machine, speed lathe, power hack saw, etc., and in the tool room a No. 1 Cincinnati universal milling machine, a Cincinnati universal grinder, a Yankee drill grinder, a brazing and tempering outfit, besides a complete equipment of small tools.

(1) **Mechanical Drawing.**—The use of drawing instruments and plain lettering; problems in geometric construction to teach accuracy in the use of instruments; isometric and cabinet projections and simple perspective. Laboratory, 3. I.

(2) **Joinery.**—A graded set of problems is given with instruction in the proper use and care of carpenter's tools and practice in working to dimensions from blue prints. Laboratory, 2, I.

(3) **Descriptive Geometry.**—Projections of lines, plane surfaces and

solids; intersections, tangents to curves and surfaces; problems in warped surfaces; practical applications. Text, Phillips & Miller. Lectures, 2. II.

(3a) **Mechanical Drawing**—Problems in descriptive geometry; finding the position of points, lines and surfaces; intersection of solids, development of surfaces; making patterns for such objects as bath tubs, boiler sheets, and other sheet metal work. Laboratory, 3. II.

(4) **Foundry.**—The instruction includes practice in floor and bench molding, core making, and in pouring castings of iron, brass and other alloys. Laboratory, 1. I.

(4a) **Pattern Making.**—A series of exercises in wood turning followed by practice in the construction of wood patterns for use in the foundry. Soph. 1. I.

(5) **Kinematics.**—A study of the relative motions of machine parts, including belting, toothed gears, cams and linkages. The class room work is supplemented by a parallel course in drafting. Text, Schwamb & Merrill, Elements of Mechanism. Lectures, 3. I.

(5a) **Mechanical Drawing.**—Applications of the principles of kinematics and drawing velocity diagrams, spur and bevel gears and cams. Laboratory, 2. I.

(6) **Forge Work.**—A graded set of exercises in iron forging, designed to teach the operations of drawing, upsetting, forming and welding, followed by exercises in forging, hardening and tempering tool steel. Laboratory, 2. II.

(7) **Steam Boilers.**—A study of the different types, their classification and construction, and of the various auxilliaries and appliances found in the boiler room. The care and operation of the steam plant. The study of combustion and the properties of steam. The work includes two and one-half hours practice per week in the college power plant. Prerequisite, chemistry (1). Lectures 3, laboratory, 1. II., Soph.

(8) **Kinematics**—A continuation of kinematics (5) Lectures, 2. II.

(8a) **Mechanical Drawing.**—A continuation of mechanical drawing. (5a) Laboratory, 1. II.

(9) **Forge Work.**—A continuation of the work in steel forging, including tempering, annealing and case-hardening. Laboratory, 2. I.

(10) **Mechanical Drawing.**—A continuation of (8a), together with the application of the Zeuner diagram to valve gear design, and the graphical solution of stresses in cranes, trusses, and structural members. Laboratory, 3. I, Jr.

(11) **Seminar.**—Weekly meetings held to discuss topics pertaining to mechanical engineering. II, Jr., I and II, Sr., 3.

(13) **Machine Design.**—Class room work, in the study of machines in regard to size, form and strength. The development and the application of mathematical formulas in the solution of problems in designing ma-

chinery. Prerequisites, M. E. 5 and 5a, and 8 and C. E. 5. Text, Machine Design by Smith & Marx. Lectures, 3, II.

(13a) **Mechanical Drawing.**—Application of the principles of machine design to size, form and strength of machines and machine parts. Laboratory, 2. II.

(14) **Engineering Laboratory**—The work consists of experimental determinations of the strength of the various materials of engineering,—cast iron, steel, tool steel, brass, wood, cement, brick, stone—in tension, compression, bending or torsion. Written reports and discussions of each test are required. Text, "Engineering Laboratory Practice," Smart. Must be taken in conjunction with applied mechanics. Laboratory, 1. II.

(15) **Valve Gears**—A study of the slide valve, both in its simple form and in combination with independent cut-off valves, link motions and other reversing gears; automatic cut-off gears, the Zeuner diagram; Prerequisites, M. E. 5, 7 and 8. Text, Spangler's Valve Gears. Lectures, 2. I.

(15a) **Engineering Laboratory.**—The calibration of indicator springs and the determination of brake and indicated horse power of steam and gasoline engines. The setting of steam engine valves by measurement and by the card, and a study of reducing motions for indicators. Text, Smart. Laboratory, 1. I.

(16) **Boiler Room and Engine Practice.**—Each student spends 2½ hours per week as assistant in the college power plant, obtaining practical experience under a first-class engineer in handling boilers, pumps, engines, heating apparatus and electrical machinery, including dynamos, motors, and switch board. Laboratory, 1. I.

(17) **Machine Work**—Instruction and practice in chipping, filing, laying out, fitting, scraping, soldering and brazing. Laboratory, 2. I.

(18) **Thermodynamics.**—A thorough course in theory, and its application, especially to the steam engine. Prerequisites, physics 1 and 2, M. E. 7, 15, 15a, and 16. Text, Peabody, Thermodynamics of the Steam Engine. Lectures, 5. 1.

(19) **Boiler Design**—A study of steam boilers with reference to setting, capacity, strength and construction. Specifications of material to be used and method of handling. Prerequisite, M. E. 7, 13, 14, and 16. Text, H. De B. Parsons, Steam Boilers. Lectures, 3. I.

(19a) **Mechanical Drawing.**—A completion of the drawing in machine design and the making of drawings for a steam boiler. Prerequisite, M. E. (13a). Laboratory, 2. I.

(20) **Engineering Laboratory.**—Calibration of instruments and apparatus for testing including indicator springs, steam gages, meters, scales and reducing motions; testing of injectors, condensers, boilers, steam and gas engines, together with calorimetric determination of the

quality of steam. Prerequisite, M. E. (7), (15) and (15a). Text, Smart. Laboratory, 3. I, Sr.

(21) **Machine Work.**—Practice with instruction in drilling, boring, turning, thread and gear cutting. Prerequisite, (12). Laboratory, 2. II.

(22) **Thermodynamics.**—A continuation of (18) in the application of the principles of thermodynamics to internal combustion engines, compressed air, refrigerating machines, injectors, condensers, and steam turbines. Lectures, 3. II.

(23) **Engine Design.**—The constructive details of some type of automatic cut-off engine, Corliss engine or steam turbine, will be worked out by the student and working drawings thereof made. Prerequisite, M. E. (7), (13), (14), (15), (15a), (16), (18). Text, Kent, Mechanical Engineer's Pocket Book; Whithan, Steam Engine Design. Laboratory, 2. II.

(25) **Industrial Organization.**—The organization and management of manufacturing establishments; cost accounting, distribution of expenses; systems of compensating labor; contracts and specifications. Lectures, 2. II.

(27) **Machine Work.**—Advanced work on lathe, milling machine, and grinder. The manufacture of reamers, drills, taps, mills, and dies. The heat treatment of high speed steel. Laboratory, 2. I.

(28) **Engineering Laboratory.**—A continuation of (20), including efficiency tests of heating, ventilating, and power plant equipment. Laboratory, 2. II.

(29) **Power Plant Design.**—The design of a modern steam power plant. The work includes the design of the structural features of the building or buildings of the plant, together with the selection, from standard types, of such apparatus as will be best suited to the requirements laid down, and the assembling of these engines, boilers, fans, and auxilliaries in such a way as will give the highest possible operating economy. Prerequisite, M. E. (14), (18), and (19). Laboratory, 3. II.

(30) **Foundry.**—Cupola and brass furnace practice, together with the study of the manufacture and properties of iron and steel, the brasses and bronzes and related alloys. Text, Smith, Materials of Machines. Lectures and Laboratory. 1. II., Soph.

Thesis.—Before graduating, the student is required to present an acceptable thesis involving an investigation of some problem related to mechanical engineering, which will become the property of the college. The work will be done under the supervision of the head of the department but the student will devise his own methods. The subject must be selected by November fifteenth of the senior year. I and II. 4.



MACHINE SHOP.



FORGE SHOP.

Division of Science.

The college offers five separate courses leading to the degree of bachelor of science, which are tabulated on the following pages. It will be noted that in these tabulations there is but little change in the actual requirements from the work offered during the past ten years. In the earlier years of the course, much of the foundation work in science, language and mathematics is common to all the courses.

The names given to these courses are generally idicative of their nature.—Biology, Chemistry, Home Science, History-Literature, and Mathematics-Physics.

Candidates for the bachelor's degree in science must complete satisfactorily not less than 130 credits, including the prescribed work in military drill or domestic science; and including also a thesis, the value of which in credits shall be determined by the instructor concerned. No regular student may take in any one semester work amounting to more than nineteen credits or less than twelve.

Students who are relieved for any reason of the requirements in military drill or domestic science, shall present four additional credits in some other subject; but the president may, at his discretion, excuse from such requirements any student in the employ of the institution.

Several subjects taught in departments not represented in this division are open to election by students in science on consent of their advisers. Among these may be mentioned music, (limited to four credits for any one person) and such subjects in the divisions of agriculture or engineering as the applicants may be qualified for, and as the schedule permits.

In the case of music elected by regular students, the college will furnish without charge a maximum of four credits to be taken in the junior or senior year, at the rate of not more than one lesson per week; and this is allowed in either the department of voice, violin or piano.

A more detailed statement of the direct purpose of these courses may be found just preceding the tabulation of each course.

Biology

Through the electives allowed in the biology course the student may select lines leading toward the following professions: general zoology, general botany, economic entomology, plant pathology, and bacteriology. The course also furnishes an excellent preliminary training for the professions of medicine, veterinary science, forestry, and teaching. In the government service, both in the Department of Agriculture at Washington and in the various experiment stations, there are many desirable openings both for young men and young women. In plant pathology, bacteriology, and entomology there is a growing demand for suitably qualified workers. Women are more and more in demand as scientific clerks and assistants. The passage of the Adams act whereby the federal appropriation to the experiment stations in the various states is materially increased, is creating a greater demand for workers in biological as in other lines, and as never before the outlook in these lines is inviting.

Students in the biology course are allowed some latitude in the election of their science work but it is intended that they shall be guided by the class officer in selecting the sub-courses that contribute most directly to their chosen line of work.

In the elective work in the junior and senior years women are allowed wide privilege.

For graduation from the course in biology, one year of Latin and a reading knowledge of French and German are required. More of each is desirable, but as soon as these amounts are accomplished, the student may elect other subjects in place of foreign language.

BIOLOGY

FRESHMAN YEAR

First Semester		Second Semester	
Eng. Comp. (Eng. 1)	2	Eng. Comp. (Eng. 1)	2
Foreign Language	4	Foreign Language	4
Gen. Botany (Biol. 9)	5	Plant Physiology (Biol. 10)	4
Gen. Chemistry (Chem. 1)	4	Gen. Chemistry (Chem. 1)	4
Draw. from Nature (Art. 4)	2	*Prin. of Plant Cult. (Hort. 1)	4
Drill	1	Drill	1
	18		19

SOPHOMORE YEAR

Expository Comp. (Eng. 2)	2	Expository Comp. (Eng. 2)	2
Foreign Language	3 or 4	Foreign Language	3 or 4
Invertebrate Zool. (Biol. 1)	5	Animal Physiology (Biol. 3)	5
Algebra and Trig. (Math. 1 & 2)	5	Geology (Geol. 1)	3
Photography (Chem. 14)	2	Organic Chemistry (Chem. 5)	5
Drill	1	Drill	1
	18 or 19		19 or 20

JUNIOR YEAR

Eng. Literature (Eng. 10)	2	Eng. Literature (Eng. 10)	2
Foreign Language	3 or 4	Foreign Language	3 or 4
Gen. Des. Physics (Phys. 1a)	3	Gen. Des. Physics (Phys. 1a)	3
General Entomology (Biol. 4)	4	Organic Evolution (Biol. 14)	2
Bacteriology (Biol. 12)	5	Elect two of the following	
		Vertebrate Zool. Biol. 2)	4
		Adv. Entomology (Biol. 6)	4
		Plant Pathology (Biol. 11)	4
	17 or 18		18 or 19

SENIOR YEAR

Eng. Comp. or Lit. (Eng. 3, 11, or 13)	2	Eng. Comp. or Lit. (Eng. 3, 11, or 13)	2
Economics (Econ. 3)	2	Economics (Econ. 3)	2
Psychology (Psych. 1)	3	Ethics (Ethics 2)	3
Thesis	5	Thesis	5
Elective	4-7	Elective	4-7
	16—19		16—19

*Women may, if desired, elect other subjects in place of Principles of Plant Culture.

Chemistry

The principles of chemistry, together with some of the applications of the science, are taught to the freshmen in all courses offered by the college. In addition to this elementary instruction some departments require sufficient training in chemistry to enable the student to apply the principles of the science to some special phase of the general course he is pursuing. This is true in the college courses in agriculture domestic science and sanitary engineering. Further, students who wish to follow chemistry as a profession are advised to take systematic training in the science during the four years of undergraduate study.

The outline of studies offered in the chemical course is designed to meet the needs of the last named class of students. It is believed such a course should provide a liberal education along with as much technical skill as it is possible to obtain. With this end in view and with the idea that the technical training should have some definite aim, two options are offered. One option gives a training in the various branches of chemistry together with several fundamental courses in biology and agriculture, the other option combines a number of carefully selected engineering studies with chemistry.

The agricultural option gives an excellent foundation for the future study of almost any phase of agricultural science. Especially it leads to agricultural chemistry as applied in experiment station laboratories. The engineering option offers a combination of studies which approaches what is usually known as a course in chemical engineering. It prepares for positions in chemical laboratories connected with manufacturing industries and for conducting operations requiring a working knowledge of both chemistry and engineering.

In the following schedule of studies, those subjects marked with one star (*) are required only of those who elect the agricultural option. The studies required in the engineering option are marked with two stars (**), while the unstarred subjects are required of all students who take the chemical course. The freshman and sophomore years are the same for both options.

CHEMISTRY

Options { * Agricultural Chemistry; **Chemical Engineering }

FRESHMAN YEAR

First Semester		Second Semester	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Algebra (Math. 1)	3	Analytical Geometry and Calculus (Math. 3)	4
Trigonometry (Math. 2)	2	General Chemistry (Chem. 1)	4
General Chemistry (Chem. 1)	4	German or French	4
German or French	4	Descriptive Geometry (M. E. 3)	2
Mechanical Drawing (M. E. 1)	3	Mechanical Drawing (M. E. 3a)	2
Drill	1	Drill	1
	19		19

SOPHOMORE YEAR

Qualitative Analysis (Chem. 2)	4	Organic Chemistry (Chem. 5)	5
Analytical Geometry and Calculus (Math. 4)	5	Analytical Geometry and Calculus (Math. 4)	5
General Physics (Phys. 1)	3	General Physics (Phys. 1)	3
Physical Meas. (Phys. 2)	2	Physical Meas. (Phys. 2)	2
German or French	3 or 4	German or French	3 or 4
Drill	1	Drill	1
	18 or 19		19 or 20

JUNIOR YEAR

Quantitative Analysis (Chem. 3)	4	Quantitative Analysis (Chem. 3)	4
Industrial Chemistry (Chem. 9)	5	Physical Chemistry (Chem. 6)	3
*Invertebrate Zoology (Biol. 1)	5	Geology (Geol. 1)	3
*Soil Physics (Agronomy 2)	5	Light and Sound (Phys. 3)	2
**Electricity and Mag. (Phys. 5)	4	Physical Meas. (Phys. 4)	2
**Foundry (M. E. 4)	1	*Animal Physiology (Biol. 3)	5
**Kinematics (M. E. 5)	3	**Foundry (M. E. 30)	1
**Drawing (M. E. 5a)	2	**Forge (M. E. 6)	2
		**Electrical Machinery (E. E. 1)	2
	19		19

SENIOR YEAR

Economics (Econ. 3)	2	Economics (Econ. 3)	2
Organic Analysis (Chem 4)	4	Organic Analysis (Chem. 4)	4
Mineralogy (Chem. 12)	3	Thesis (Chem. 16)	2
Thesis (Chem. 16)	2	*Plant Physiology (Biol. 10)	4
*General Botany (Biol. 9)	5	*Soil Fertility (Agronomy 3)	3
*Elective	3	*Elective	4
**Applied Electricity (E. E. 3)	3	**Assaying (Chem. 13)	4
**Elective	5	**Dynamos and Motors (E. E. 5)	4
		**Dynamo Testing (E. E. 6)	2
	19		18 or 19

History and Literature

In accordance with the general plan of the division of science, this course leads to the degree of bachelor of science. It includes properly, therefore, strong courses in at least two or three sciences, physics, chemistry and biology, though it does not contemplate advanced work in any of these subjects. Throughout the course a large amount of time is devoted to the study of foreign language and during the later years of the course a good deal of time is given to history and literature. It is not expected that the graduate in this course will be technically equipped in any of these subjects, though by the systematic arrangement of his electives he may emphasize such lines of the work as he is especially attracted to. Graduates should therefore be fitted to teach in the high schools, history, English, and one or more of the foreign languages. The prime purpose of the course, however, is to offer to those who can afford it a good general education, the purpose of which shall be a wide acquaintance and sympathy with the most important ideas and activities of civilization.

Such an education, it is believed, is well worth having for its own sake; and for those who can afford the time, it is a valuable preparation for the specialization of the graduate school, or of the professional or technical school.

HISTORY AND LITERATURE.

FRESHMAN YEAR.

First Semester		Second Semester	
English Comp (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (Eng. 4)	1	Public Speaking (Eng. 4)	1
Algebra (Math. 1)	3	Anal. Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Foreign Language (Fr., Ger., or Latin)	4
Foreign Language (Fr., Ger., or Latin)	4	Art	2
General Chemistry (Chem. 1)	4	Military Drill	1
Military Drill	1		
or Sewing (H. S. 11)	3		
	17 or 19		17

SOPHOMORE YEAR.

English Composition (Eng. 2)	2	English Composition (Eng. 2)	2
English Literature (Eng. 10)	2	English Literature (Eng. 10)	2
Foreign Language	6 or 8	Foreign Language	6 or 8
European History (Hist. 1)	3	European History (Hist. 1)	3
Military Drill	1	*Elective	2-6
*Elective	2-6		
	15-19		15-19

JUNIOR YEAR.

**Economics (Econ. 3)	2	Foreign Language	2-4
Foreign Language	2-4	Economics (Econ. 3)	2
English Literature or Composition (English 3, 11 or 13)		English Literature or Composition (English 3, 11, 12 or 13)	
or History (2 or 5)	2-3	or (History (2 or 5)	2-4
*Elective	9-12	*Elective	6-11
	16-19		16-19

SENIOR YEAR.

Psychology (Psych. 3)	3	Ethics (Ethics 2)	3
Sociology (Philosophy 4)	3	Thesis (3)	6
Elective	9-13	Elective	6-10
At least 4 credits must be taken in either History, English or Foreign Language.		At least 4 credits must be taken in either History, English or Foreign Language.	

*All candidates for a degree in this course must take a year of work either in physics or biology. All young ladies are also advised to take one course in cooking.

**The order in which the required subjects are to be taken up in the junior and senior years may be varied upon the consent of the class officer and the instructor concerned.

Home Science.

The object of this course is two-fold: First, to give young women a liberal education with a scientific basis and to train them along lines pertaining to the science, management and care of the home. Second, to give training to those who wish to become teachers of home science. This course gives an opportunity for the combination of biology and chemistry with home science.

In the junior and senior years there is considerable opportunity for electives, but electives must be chosen by the advice and with the approval of the class officer. History, German, French, art, music and debates may be elected in the junior year. History, chemistry, biology, art, music and debates may be elected in the senior year.



Home Science Reception Room.

HOME SCIENCE.

FRESHMAN YEAR.

First Semester		Second Semester	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (Eng. 4)	1	Public Speaking (Eng. 4)	1
German (Mod. Lang. 10 or 12)	4	German (Mod. Lang. 10 or 12)	4
Trig. and Logs. (Math..) 2a)	3	Applied Algebra (Math. 7)	2
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
Sewing (H. S. 11)	3	Cooking (H. S. 1)	4
Art (Art 1)	1	Art (Art 1)	1
	18		18

SOPHOMORE YEAR.

Expository Composition (Eng. 2)	2	Expository Composition (Eng. 2)	2
German (Mod. Lang. 11 or 13)	2 or 4	German (Mod. Lang. 11 or 13)	2 or 4
Food Chemistry (Chem. 8)	5	Food Studies (H. S. 2)	4
Invertebrate Zoology (Biol. 1)	5	Animal Phys & Anat. (Biol. 3)	5
Dressmaking (H. S. 12)	2	Architecture and Sanitation (H. S. 3)	2
	16 or 18		15 or 17

JUNIOR YEAR.

Economics (Econ. 3)	2	Economics (Econ. 3)	2
Bacteriology (Biol. 12)	5	Dietetics (H. S. 6)	2
Advanced Cooking (H. S. 4)	2	Topical Discussions (H. S. 7)	2
Home Nursing and Invalid Cookery (H. S. 5)	2	Advanced Dressmaking (H S. 14)	3
Textiles (H. S. 13)	2	European History (Hist. 1)	3
European History (Hist. 1)	3	or Organic Chemistry (Chem. 5)	5
or Qualitative Analysis (Chem. 2)	4	Elective	6
Elective	2		
	18 or 19		18 or 19

SENIOR YEAR.

Psychology (Phil. 1)	3	Ethics (Phil. 2)	3
Teachers' Course (H. S. 8)	3	Teachers' Course (H. S. 8)	2
Teaching of Domestic Art (H. S. 15)	3	Sewing (H. S. 16)	2
French, German or English	2 to 4	French, German or English	2 to 4
Thesis	2 to 4	Thesis	2 to 4
Elective	5 to 3	Elective	4
	18 or 19		15 to 19

Mathematics and Physics.

This course as outlined on the opposite page is designed to fill the needs of two or three classes of students. The required work is such as to give an excellent preparation for students desiring to become teachers in these subjects, and by proper choice of the electives a broad education in other subjects may be obtained. Prospective teachers are advised to arrange their electives so that they will be qualified to teach other subjects, such as biology, chemistry, English or foreign language, as often they are required to teach such subjects in combination with mathematics or physics.

There is an increasing demand for men who have a more extended and exact knowledge of the fundamental sciences than can be obtained from the ordinary technical course. This call comes from a class of employers who desire men so equipped and prefer to give them the practical training they need. This course is designed to give the theoretical training. If the student should take this course, planning to take an engineering course later, he can choose his electives so that any of the engineering courses may be completed in two years after graduation from the Mathematics-Physics course. In this case the following subjects are suggested from which it is desirable to elect: Freehand drawing, mechanical drawing, chemistry, mechanics, applied electricity, dynamos and motors, hydraulics, sanitary engineering. The particular electives of this course will be chosen in accordance with the direct aim of the student. In addition, the above course lays a foundation for the work of the graduate school.

MATHEMATICS-PHYSICS

FRESHMAN YEAR.

First Semester.		Second Semester.	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (Eng 4)	1	Public Speaking (Eng. 4)	1
Algebra (Math. 1)	3	Anal. Geometry and Calculus (Math. 3)	4
Trigonometry (Math. 2)	2	German or French	4
German or French	4	General Chemistry (Chem. 1)	4
General Chemistry (Chem. 1)	4	Military Drill	1
Military Drill	1		
	17		16

SOPHOMORE YEAR.

Expository Composition (Eng. 2) or English Literature (Eng. 10)	2	Expository Composition (Eng. 2) or English Literature (Eng. 10)	2
Analytical Geometry and Calculus (Math. 4)	5	Analytical Geometery and Calculus (Math. 4)	5
General Physics (Phys. 1)	3	General Physics (Phys. 1)	3
Physical Measurements (Phys. 2)	2	Physical Measurements (Phys. 2)	2
German or French	3 or 4	German or French	3 or 4
Elective	0 to 4	Elective	0 to 4
Drill	1	Drill	1
	17-20		17-20

JUNIOR YEAR.

Differential Equations Math. 10)	3	Geology (Geol. 1)	3
Electricity and Magnetism (Phys. 5) or Least Squares (Math. 5)	4 or 2	Differential Equations (Math. 10)	3
		Light and Sound (Phys. 3)	2
		Physical Measurements (Phys. 4)	2
Economics (Phil. 3)	2	Economics (Phil. 3)	2
Elective	6 to 10	Elective	6 to 8
	17-19		17-19

SENIOR YEAR.

Theoretical Astronomy (Math. 6)	3	Theoretical Astronomy (Math. 6)	3
Two Courses from Advanced Phys. (Phys. 6) and Mathematics (11, 12, 13 or 14)	3 2 or 3	Two Courses from Advanced Phys. (Phys. 6) and Mathematics (11, 12, 13 or 14)	3 2 or 3
Elective and Thesis	7 to 11	Elective and Thesis	7 to 11
	17-19		17-19

Art.

MRS. MARSALL.
MRS. GAGE.
MISS KOUNTZ

Upon entering the art department we find ourselves in a suite of spacious studios, occupying the one hundred-foot north front of College Hall, and lined with objects of art.

Here are many plaster casts from the antique, comprising, among other things, full length figures of the Venus of Milo, the Running Gladiator, and the Winged Victory. There are also portrait busts of Cicero, Sophocles, and other celebrated characters, and many masks of different types and nationalities.

There are many fine reproductions of the Barrie bronzes and other casts of animals, birds, flowers, and fruits. Many of the great styles of architecture and ornament are represented in plaster, from Egyptian down to the Renaissance.

We shall find many photographs from foreign countries, and reproductions of celebrated pictures in engravings and etchings. There is also a fine collection of works on art, suitable for class reading or serious study.

Among the other equipment for work the department has a china kiln of the largest size, in which the china painted by the classes is fired on the premises.

There are full sets of tools for wood carving, which are at the service of students, and an instrument for pricking and applying patterns for embroidery.

If we visit the studios during the class hours we find students working in many branches of art,—some in wood carving and clay modeling, some in painting on china, while in other rooms they may be drawing from the antique, painting in water-color, oil, or pastelle, studying applied design or taking lessons in perspective, or other work connected with the engineering departments.

Lectures on art often take the shape of imaginary tours in the great cities, and through the great galleries of the world, and are illustrated by pictures and stereopticon.

Attention is called to the regulation printed on page 17 regarding the keeping of work suitable for exhibition.

(1) **Drawing** from the cast, in charcoal, crayon or pen and ink, still life and object drawing, sketching from nature when the weather will permit. Study of plant forms, with suggestions for their application to design. In object drawing the pupil is required to study artistic grouping and good arrangement of light and shade. Memory and time drawing blackboard work. I and II, 4.

(2) **Painting**—Oil, water color, or pastelle. Prerequisite, Art 1. I and II, 6.

(3) **Freehand Drawing for Engineers.**—Perspective as applied to sketching from natural objects, freehand lettering, blackboard dictation, object drawing, with proper shading, freehand drawing of machinery, use of water color in connection with mechanical work, study of architectural styles, tests for color signals. I and II, 4.

(4) **Drawing From Nature.**—Drawing and painting of plants and animals, intended especially for students in biology. It may be taken in either semester separately. I and II, 2—6.

(5) **Normal Work.**—This is a course in the training of the eye and hand and in the methods of teaching, intended especially for those who may be planning to teach art. Those who take this work will be allowed some opportunity for practice in teaching under the direction of the head of the department. I and II, 4—8.

(6) **Wood Carving and Clay Modeling.**—Tools and clay provided by the department. I or II, 2.

(7) **Applied Design.**—Study of color schemes and color harmony, with historic ornament, leading up to practical designing for various handicrafts. Each student will occasionally submit original designs for embroidery, wood-carving, and other decorative work based upon natural forms. Courses I and 2 are prerequisite. I or II.

(8) **Figure Study.**—A life class open to all who show talent for drawing from the human form. Study of costume. I or II, 2.

(9) **Painting on China.**—Students to be admitted to the work in china painting must satisfy the instructor that they have the necessary preparation to undertake the work profitably. China is fired in the studio. Courses 1 and 2 are prerequisite. I or II, 2 to 8.

Biology

PROFESSOR COOLEY
PROFESSOR SWINGLE
ASSISTANT PROFESSOR SPAULDING

The biology department now occupies the whole of the building formerly used also by the Experiment Station and agricultural departments. The building has been remodeled and made more suitable for biological work

In the basement is a class room, an herbarium room and rooms for storage. One large room is devoted to receiving and unpacking apparatus and supplies and for rough storage. The entire west half of the first floor is a large laboratory for the use of students. This is equipped with large heavy tables, individual lockers and apparatus cases as necessary, and accommodates thirty students. The east half of the first floor is occupied

by the office of the department, a private laboratory for the station entomologist and the department library.

The laboratories on the second floor accommodate about fifty students and are equipped with heavy tables with drawers. These rooms are supplied with gas. Individual lockers and cupboards for the convenience of students in bacteriology, physiology and general botany and zoology are in these rooms.

Opening off the bacteriological laboratory are three culture rooms for transferring basteria without danger of contamination and an incubator room where an incubator and parafin bath are maintained at constant temperatures.

A greenhouse attached to the building on the south side contains a laboratory and a small hothouse. This laboratory and greenhouse combined are for the exclusive use of classes in plant physiology and plant pathology and are especially constructed to that end. Both are under glass and are provided with cement floors that plants may be carried from one to the other without suffering change of environment. Opening out of the physiological laboratory is a large dark room, with double doors, equipped for experiments illustrating the action of light and darkness on the behavior and growth of plants.

The greenhouse is attractively furnished with plants, both ornamental and illustrative; and the laboratory has aquaria in which running water keeps algae and other aquatic plants growing the year round.

Among the more important pieces of apparatus available for work in the various branches of botany and zoology are the following: Forty-six compound microscopes, seven of which are equipped with excellent oil immersion lenses of the best make in this country and Europe. Beside the regularly required lenses attachable to these microscopes are a fine series for special purposes, including those made especially for photomicrographic work; a Filar micrometer and several stage and eye-piece micrometers for the accurate measurement of microscopic objects; four dissecting microscopes with rack and pinion adjustment of the lenses, of which there is a series with each instrument; twenty-two very serviceable dissection microscopes of less expensive construction; one rotary microtome for rapid and fine work, one Minot automatic precision sliding microtome especially constructed for sectioning wood and well adapted for general work; a large supply of dissecting instruments; two paraffin baths with attachments for maintaining a constant temperature; a good working set of stains and other chemicals for histological work in both animal and vegetable tissues; two incubators with constant temperature attachments, serviceable in embryological and bacteriological work; one large size eclipse type of autovalve, the most up-to-date and serviceable of any now available; one hot-air sterilizer of the large improved Lautenschlager type; one Koch sterilizer; one Arnold sterilizer; one Ganong Clinostat; one

Draper self-recording thermometer; one Draper self-recording hygrometer; six auxonometers; two photosynthometers; two respirometers; two potometers and six warm stages.

Besides the pieces above listed the department owns a large quantity of general apparatus, glassware and chemicals, sufficient for giving, in a thorough manner, all the sub-courses listed in this department.

It is the purpose of the biological library to furnish the students with full and up-to-date knowledge of all zoological, botanical and bacteriological subjects taught at the college and such special subjects as may be taken up for research work.

Of the larger and more important works are Saccardo's "Sylloge Fungorum" for the identification of fungi; Engler and Prantl's "Pflantzenfamilien," covering the entire plant kingdom; DeToni's "Sylloge Algarum" for the algae and the Kew Index and Britton and Brown's "Illustrated Flora of North America," relating to the flowering plants, and most of the more important classic and recent works on plant morphology, physiology and classification and on the various phases of bacteriology. There are also several hundred pamphlets dealing with special lines of botanical work, and a full set of bulletins of the state experiment stations and the U. S. Department of Agriculture, which are rich in research papers on botanical subjects.

To keep up with the most recent discoveries, we receive regularly a number of the best botanical periodicals published in this country and abroad, and we are constantly adding to our library as our special needs require.

The department is well equipped with necessary zoological literature.

Special attention has been paid to accumulating titles relating to entomology and physiology, as well as general zoology. Among the more important books may be mentioned the following: General Insectorum (complete), Zoological Record, Entomological News (complete), Canadian Entomologist (complete), Zoologische Anzeiger, Anatomischer Anzeiger, Psyche (complete), transactions of the American Entomological Society. Besides these there are a large number of books treating of the various branches of zoological science. These, together with a large number of unbound pamphlets, constitute a good working library.

The department has purchased the entomological section of the Concilium Bibliographicum and is a subscriber to the additional cards. This catalogue and one of about 35,000 references, made by the department, are of great service in facilitating the library work of the students in entomology.

A large, well selected, and rapidly growing series of microscopical mounts, including histological preparations of animal and vegetable tissues, bacteria and dissected parts of plants and animals is available for the use of students and is of great value in their instruction.

For preparing lantern slides, prints and other illustrative material for the students, for illustrating thesis and research papers and to acquaint the student with photographic methods, the biology department is provided with several good cameras. Among these are a 5x7 camera provided with a Bausch and Lomb make of the Zeiss convertible anastigmatic lens, series VII, a lens for general use, and a Bausch and Lomb photomicrographic outfit, including one special lens and two specially constructed microscope objectives. There are two dark rooms, one exclusively for photographic use and one in connection with the physiological laboratory used for photographic work during vacations and at other times when not in use by students in their experiments with plants. A good supply of chemicals for making the various developers, etc., is always on hand.

On the third floor, opposite the museum, is a well lighted lecture room which can be quickly darkened for the use of the electric lantern on a raised platform in the rear of the room. Fully one thousand lantern slides are in the department for use in illustrating the lectures. A large part of the Kny series of botanical charts in colors and in black and white, and a series of zoological charts after Leukart are also used with the lectures.

(1) **Invertebrate Zoology**—Devoted to a study of the invertebrate animals, including their morphology, development, habits, economic or popular interest, and classification. The broad biological principles are brought out and emphasized. The class room work is based on "Galloway's Text Book of Zoology." The laboratory exercises include a study of the morphology of types, reference reading and practical work in the classification of the animals. Required of agricultural and general science students except those in the mathematics and physics group. Lectures, 2; laboratory, 3. I. 5. Assistant Professor Spaulding.

(2) **Vertebrate Zoology.**—A continuation of (1), taking up vertebrate (chordate) forms. Required of agriculture and biology students. Elective for those who have taken (1). Lectures, 1; laboratory, 3. II, 4. Assistant Professor Spaulding.

(3) **Animal Physiology and Anatomy**—By means of lectures and demonstrations the main principles of animal physiology are presented to the students, while in the laboratory they become familiar with the most important features of mammalian anatomy. Required of agriculture, home science, pharmacy, and biological students. Elective for general science students who have taken (1). Lectures, 3; laboratory, 2. II, 5. Assistant Professor Spaulding.

(4) **General Entomology.**—Lectures on the morphology, metamorphoses and classification of insects and a study of the various orders. Collecting, naming, labeling and arranging in museum form species that are to be found in the vicinity of Bozeman. Required of biology and agricultural students. Elective for others who have taken (1). Lectures, 2; laboratory, 2. I, 4. Professor Cooley.



CHEMISTRY—PHYSICS LABORATORIES.



BOTANY LABORATORY AND ZOOLOGY.

(5) **Advanced Entomology.**—This course is a continuation of the general entomology course (4), and is made up of lecture, reading and conference work and of laboratory exercises. Students in this course will be assigned laboratory work best suited to their special requirements. Forestry students will take up a detailed study of the insect pests of the forest, while regular biology students will be assigned more technical subjects. Lectures, 2; laboratory, 2. II, 4. Professor Cooley.

(6) **Economic Entomology.**—Principles underlying insect depredations and their control; insecticides and insecticide machinery; notable insect pests of our time and of earlier times; entomological journals and early literature; prominent workers of today and earlier times. Lectures, 3; laboratory, 1. II, 4. Professor Cooley.

(9) **General Botany.**—Morphology, anatomy and elementary physiology of plants, including life history studies of all the groups. The fundamental biological principles are here laid down on which all higher botanical studies are based. Required of all science and agriculture students. Lectures, 2; laboratory, 3. I, 5. Professor Swingle.

(10) **Plant Physiology and Histology.**—Experimental work in the movement, growth, nutrition and reproduction of plants with a microscopical study of the structure involved. Must be preceded by biology (9) and 1st sem. of chemistry (1). Required of agriculture and biology students. Lecture, 1; laboratory, 3. II, 4 Professor Swingle.

(11) **Plant Pathology.**—General facts and principles governing the health and disease of plants, with illustrative experiments, followed by a study of the classification, morphology, and special physiology of parasitic plants, with especial reference to diseases of cultivated crops in Montana. Must be preceded by (9) and (12). Required of agronomy and horticulture students. Lectures, 1; laboratory, 3. II, 4. Professor Swingle.

(12) **Bacteriology.**—A study of the structure, life history and classifications of bacteria, their growth in nutrient media, and methods of bacteriological technique. The relation of bacteria to agriculture, disease, and our daily life is discussed. Must be preceded by biology (9) or (3) and chemistry (1). Required of agriculture and home science students. Lectures, 2; laboratory, 3. I, 5. Professor Swingle.

(13) **Embryology**—An introductory course in embryology, embracing a study of the formation and growth of tissues in the vertebrate body, based chiefly on a study of the chick, but including consideration of the development in the mammalia. Open to students who have completed biology (2) or (3). Lecture, 1; laboratory, 3. I, 4. Assistant Professor Spaulding.

(14) **Organic Evolution.**—A lecture course treating of the different evolution theories and their present status; will also include such topics as the origin of species, heredity, variation, natural and artificial selection, adaptations, etc. Lectures and assigned reading. Required of agricul-

ture and biology students and elective to students who have completed at least two courses in biology. Lectures, 2. II, 2. Assistant Professor Spaulding.

(15) **Thesis.**—Students in the biology course in their senior year and seniors from other courses, who have had sufficient previous training in biology, may devote a maximum of five credits per semester to thesis work, under the direction of Professors Cooley or Swingle, or Assistant Professor Spaulding

Chemistry.

PROF. COBLEIGH.
ASS'T PROF. BURKE.
MR. ROBINSON

The applications of chemistry to the various phases of agriculture, to engineering and to many modern industries, make this science an important one in a technical school. The fundamental courses of the science should be thoroughly taught in order that the student may have sufficient training and independence to apply his knowledge to practical operations. If the student is to master the principles of chemistry and at the same time obtain a working and practical knowledge of chemical manipulation, he must have certain facilities at his disposal.

Below is given, somewhat in detail, a description of the equipment and the conveniences provided for the study of chemistry in this institution:

The lecture room, with raised floor and seating capacity for one hundred and fifty students, has a lecture desk provided with water, gas, and electricity, a demonstration balance and a stereopticon for showing the applications of the science. The class room exercises in general and applied chemistry are illustrated by experiments, lantern slides, and in many cases by exhibits of the raw materials and finished products of commercial processes. The lecture room equipment is in an adjoining room, which also serves as a private laboratory.

There are five laboratories equipped for the following lines of work: General chemistry, qualitative and quantitative analysis, organic and food chemistry, physical chemistry, and assaying. All desks are provided with water, gas, electricity, and filter pumps where needed. The hoods in each laboratory are furnished with gas and water and connections from a large Parson's hydrogen sulphide generator which will supply forty jets at one time. In each hood there are large steam and air baths, in operation at all times, being connected to the steam heating plant. The building is well ventilated by means of a mechanical draft, and heated by a direct indirect steam system. With some of the classes working in sections the laboratories will accommodate 150 students

The store room is stocked with an ample supply of the apparatus and chemicals needed for the various laboratory courses. The student secures what equipment he needs from time to time in addition to that always kept in his desk, from the store keeper, who is on duty at convenient and stated hours. The equipment includes, besides the usual stock of apparatus, much that is designed for special use, such as accurate balances for both quantitative analysis and assaying, standard weights, equipment for calibrating measuring apparatus, polariscopes. Abbe refractometer, oil testers, apparatus for water, air, and gas analysis, combustion furnaces, Hoskin's crucible and muffle furnaces for assaying and for experiments necessitating high temperatures, apparatus for gas density determinations, and Beckham's freezing and boiling point apparatus, and equipment for conductivity measurements, etc.

The department museum occupies a well lighted room in the basement. In this room are stored in cabinets, and glass exhibit cases, the collections illustrating chemical industries of various kinds, and the mineralogical and geological specimens. The mineral collection is quite extensive. It includes a valuable private collection purchased by the college some years ago. To this was added a part of the Montana mineral exhibit at Chicago in 1893, and large additions have been made from time to time through exchanges and purchases. The collection is thoroughly representative and forms an important adjunct to the chemical department.

The chemical library and office is located on the first floor and contains full sets of the American Journal of Science, Journal of the American Chemical Society, Journal of the (London) Chemical Society, Berzelius Jahresbericht, Bericht der deutschen Chemischen Gesellschaft, and Fresenius Zeitschrift fur Analytische Chemie. There are also partial sets of Chemical News, and the Analyst. Besides these the library contains many standard references works and the recent text books. There are also index volumes and card catalogues to facilitate more ready reference to the literature.

(1) **General Chemistry.**—Two lectures, one recitation and one 2½ hour laboratory period per week throughout the year on the fundamental laws of chemistry, the history, occurrence, preparation and properties of the common elements and their compounds. High school physics is prerequisite. Text books, Smith's College Chemistry and Lenher's Laboratory Manual. I and II, 8.

(2) **Qualitative Analysis.**—Lectures and recitations two hours per week on the theory and practice of qualitative analysis, the properties of solutions, laws of ionization and mass action as applied to analytical chemistry Laboratory practice two afternoons per week in the analysis of simple salts, complex mixtures, ores and minerals. Text books, Qualitative Analysis by Dennis and Whittelsey; Qualitative Chemical Analysis by Tower. Chemistry (1) is prerequisite. I, 4.

(3) **Quantitative Analysis.**—Two lectures and recitations per week on the theory and technique of the laboratory methods and chemical calculations. Five hours of laboratory work per week. The analyses required in the course include the following: Magnesium sulphate, potassium alum, from ammonium alum, iron ore, limestone, clay or slag, zinc, lead, copper, manganese, arsenic, antimony, and nickel ores alkalimetry, acidimetry coal and flue gas. Chemistry (1) and (2) are prerequisite. Text books, Miller's Notes on Quantitative Analysis for Mining Engineers, Treadwell's Quantitative Analysis, and Miller's Calculations of Analytical Chemistry. I and II, 8.

(4) **Organic Analysis.**—Lectures and recitations on the methods used for the analysis of organic substances and agricultural products. The laboratory portion of the course includes analyses of the following: Feeding stuffs and cereals, fertilizers, soil, sugar, milk, butter, oils, alcohol, glycerol, formaldehyde, and the detection of adulterations in food. Chemistry (3) and (5) are prerequisite. Text book, Proximate Organic Analysis by Sherman. I and II, 8.

(5) **Organic Chemistry.**—An elementary course designed to make the student familiar with the principles of organic chemistry and with the more important compounds of both the aliphatic and the aromatic series. Remsen's Organic Chemistry is used in the class room and the laboratory work is based on Orndorff's Laboratory Manual, and Gaetterman's Practical Methods of Organic Chemistry. Chemistry (1) is prerequisite. II, 5.

(6) **Physical Chemistry.**—A course in theoretical chemistry consisting of lectures, recitations, assigned problems, and laboratory work. The class room discussions include the following topics: The gas laws, thermodynamics, solutions, chemical mechanics, equilibrium in electrolytes, and electro-chemistry. The laboratory work includes vapor density determinations, freezing point, boiling point, and conductivity methods, etc. Text books, Morgan's Physical Chemistry for Electrical Engineers; Ostwald's Physico-Chemical Measurements. II, 3.

(7) **Agricultural Chemistry.**—This course is designed especially to meet the needs of the students in the four year course in agriculture. Lectures and recitations on the chemistry of soil, manures and fertilizers, plants, and animal products. The laboratory work includes the following analyses: Magnesium sulphate, potassium alum, iron and ammonium alum, limestone, soil, cereal or feeding material, milk or butter. Text books, Ingle's Manual of Agricultural Chemistry, Lincoln and Walton's Quantitative Analysis for Agricultural Students. Chemistry (2) and (5) are prerequisite. I, 4.

(8) **Food Chemistry.**—This course is designed for students in the home science and the two year pharmacy courses. The first few weeks of the course deal with organic chemistry which will serve as a preparation for the study of the composition of different foods, and their functions, the

preservation and adulteration of foods. The class work will be supplemented with appropriate laboratory exercises. Chemistry (1) is prerequisite. Text book, Sanitary and Applied Chemistry by Bailey. I, 5.

(9) **Industrial Chemistry.**—Lectures, recitations, and assigned reading on the industrial applications of chemistry. The topics considered will depend, to a certain degree, upon the purposes of the students who take the course. In general it will include fuels, refractory materials, limes, mortars, and cements, building stones, timber and its preservation, the properties of iron and steel, the treatment of the ores of lead, gold, silver, and copper, illuminating gas, explosives, etc. Chemistry (3) or (7) and (5) are prerequisite. I, 5.

(10) **Water and Air Analysis.**—A course designed for students in sanitary engineering. The sanitary analysis of water and air, with discussions on the proper interpretations of analytical results. The first semesters of chemistry (3) and of chemistry (5) are prerequisite. Text books, Mason's Water Supply, and Richard and Woodman's Air, Water and Food. II, 2.

(11) **Animal Nutrition.**—Lectures on the functions of fats, carbohydrates, protein, and salts in nutrition together with a study of the chemistry of digestion and metabolism. Chemistry (5) and chemistry (7) or (3) are prerequisite. II, 3.

(12) **Mineralogy.**—Blowpipe analysis, elementary crystallography and determinative mineralogy. Lectures and laboratory work. Text book, Moses and Parson's Mineralogy. I, 3.

(13) **Assaying.**—Conferences, recitations, and laboratory work. Testing the purity and reducing power of fluxes, fire assay for lead, gold, and silver ores, and gold and silver bullion, chlorination assay, cyanide and amalgamation tests. Chemistry (3) and (12) are prerequisite. Text book, Fire Assaying by Fulton. II, 4.

(14) **Photography.**—Lectures on the chemistry and manipulation of photographic processes. Laboratory practice in exposing, developing, printing, toning, making lantern slides and enlargements. I, 2.

(15) **Seminar-Abstracting.**—In order to develop in the student a habit of careful reading, each student will be required to make abstracts of articles on assigned subjects from the leading journals, and present them at weekly meetings of the students and department instructors, where the topics are freely discussed. Students are thus kept in touch with the progress of the science. I and II, 2.

(16) **Thesis.**—Students in the chemistry course are required in the senior year to prepare a graduating thesis on some subject which will involve considerable laboratory work and as much originality as possible. I and II, 4.

English.

PROF. BREWER.
MR. DUDDY.

The library has abundant equipment for all the work offered in English. There are complete standard texts of practically all the authors referred to in any of the courses. Besides these there is a fair supply of biographical, critical and historical works, sufficient for ordinary reference use. The library equipment is complete enough so that thus far students have been able to do the reading assigned without the necessity of purchasing many books.

Though many classic novels are to be found on the shelves, no effort has been made in the college library to provide current fiction.

In all the courses in English, written work plays an important part. That this work may be kept up to a proper grade, it is announced here that in college English work no paper will receive any credit that shows notable carelessness or ignorance in elementary matters of punctuation, grammar, rhetoric, or in the spelling of common words.

(1) **English Composition**—This course is required of all freshmen. The course is almost altogether practice in various types of prose composition; narration, description, exposition, criticism, and argumentation. The class meets ordinarily twice a week. The instructor from time to time meets each student for private conference about his work. Lectures. I and II, 4. Prof. Brewer and Mr. Duddy.

(2) **Expository Composition.**—This is a course primarily in expository writing and intended for students who will go into scientific or technical work. Papers prepared in scientific or technical courses, if not too technical, may be handed in as part of the work of this course. The year's work will also include some practice in argumentative writing in preparation for English (5). I and II, 4. Prof. Brewer.

(3) **Advanced Composition.**—This is an advanced course for those who wish to study composition as a fine art. It will include a study of the historical development of English prose style and such other work as may suit the taste or needs of those who elect the course. Lectures. I and II, 4. Prof. Brewer.

(4) **Public Speaking.**—Informal lectures; drill in articulation and intonation. Declamation exercises with criticism by instructor and students. Extemporaneous speaking and training in the writing of the different forms of public discourse. The course will close with a study of the essential principles of debating; each student will be required to take part in at least one debate. Required of all freshmen. I and II, 2. Mr. Duddy.

(5) **Argumentation and Debating.**—Study of the principles of

argumentation and master pieces of forensic oratory. Preparation of briefs and forensics. Conferences, lectures, debates and other forms of public address. Elective for seniors and juniors who have credit for courses (1), (2), and (4). I and II, 4. Mr. Duddy.

(10) **English Literature.**—A reading course in English literature including about twenty of the more important authors. A large amount of reading is required and more recommended. Written reports on the reading are frequently required. A part of the class room time is given to critical reading of English masterpieces. Lectures, recitations, and conferences. I and II, 4. Prof. Brewer.

(11) **English Essayists of the Nineteenth Century.**—A study of the more important essayists from Charles Lamb to R. L. Stevenson. Lectures and recitations. I and II, 4. Prof. Brewer.

(12) **Shakespeare.**—A careful reading of three plays in the class room, and outside reading in other plays of the period. Lectures and recitations. II, 4. Prof. Brewer.

(13) **Victorian Poetry.**—A study of the poetry of the Victorian period, with special reference to the work of Alfred Tennyson, Robert Browning, and Matthew Arnold. Lectures and recitations. I and II, 4. Prof. Brewer.

Course 10 is given every year and is prerequisite to courses 11—13. Courses 11—13 are not all given in the same year. Classes will be organized when a sufficient number of students elect any course.

Special Assigned Composition.—In accordance with a vote of the faculty, any college student who in any department hands in a theme, thesis, examination paper, lecture notes, or other written work which shows deficiencies in English, may be referred to the department of English with the paper in question and work will be assigned him of such kind and amount as to provide against any recurrence of poor work. Satisfactory completion of any such assignments will be requisite for graduation, but no credits will be allowed for this work.

Special Credits.—Students who enter inter-collegiate or inter-class debates or the oratorical contests, or who work upon the college papers or do other newspaper work, may have that work credited to them in this department in amount as may be agreed with the head of the department, either in place of other required work in English, or as elective work.

Geology.

PROF. COBLEIGH

The vicinity of Bozeman is an excellent locality for the student of geology. It affords many opportunities for studying the action of forces now in operation and also for observing the effects these forces have pro-

duced in the past. The geology of this locality has been worked out by the U. S. geological survey and the survey publications are in the college library.

The college museum contains excellent collections of minerals, rocks, and fossils, which are used for class room study. A set of lantern slides is used for illustrating the lectures.

(1) **Geology.**—Lecture, recitations, and assigned reading in dynamical and structural geology. Text book, Scott's Introduction to Geology. Chemistry (1), prerequisite. II, 3.

History.

MISS BREWER.

The department has a set of MacCoun's historical charts of the United States and two sets of historical geography charts of Europe by the same author; Johnson's series of maps of ancient geography; ten of Bretschneider's maps of medieval Europe; and a set of maps of the modern world.

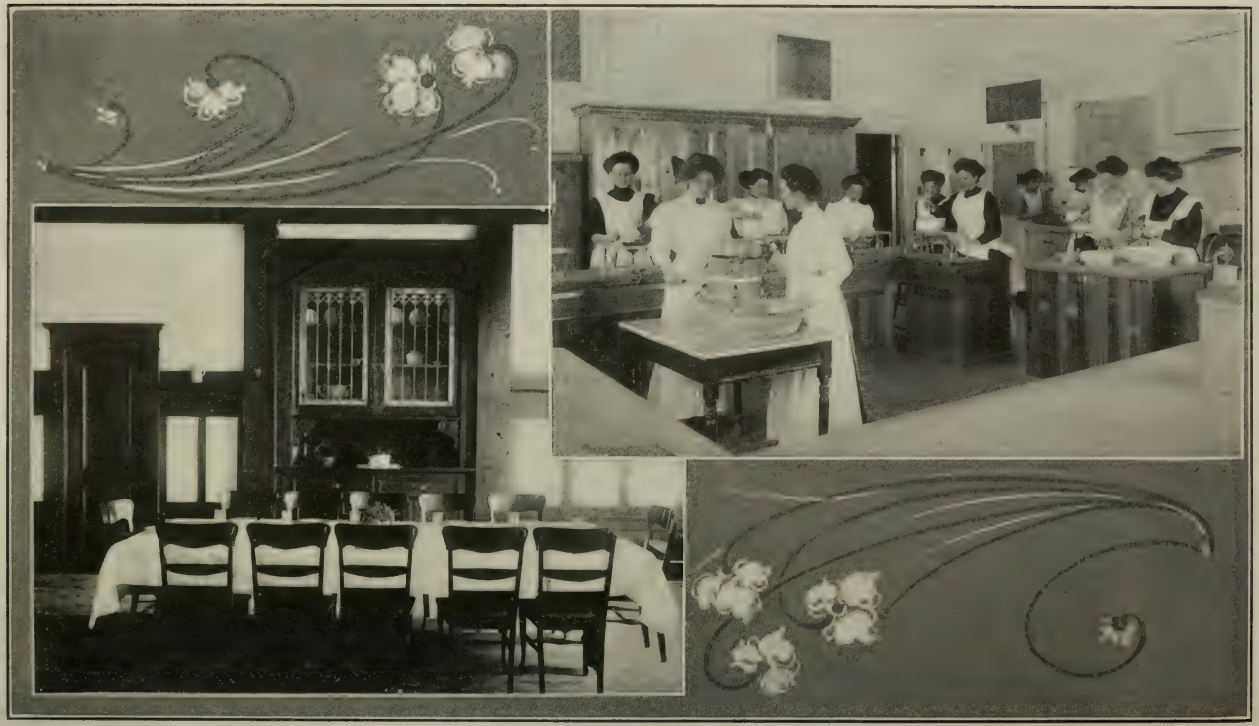
The library contains the laboratory of the historical department, but a catalogue of the histories would be too voluminous to include here. In Greek and Roman history, besides the standard narrative works, there are translations of the best source material for this period. For English history the library is well equipped with general works and has source material including Colby, Lee, and the University of Pennsylvania collection, Evelyn's Diary, a file of "The Gentleman's Magazine," etc.

Naturally the works on the United States history are the most numerous. The standard general histories, as well as works on limited periods or regions, and the best biographies of American statesmen, are in the library. The reports of the American Historical Association, and the Congressional Records, come to the library. There are also many contemporary records, among which are the Old South Leaflets, Hart's American History Told by Contemporaries; the complete works of Jefferson, Hamilton and other statesmen, and the Jesuit Relations.

The college reflectoscope is available for showing pictures of historic scenes and objects. A large number of views belonging to the teacher are used in all classes.

(1) **European History.**—It is taken for granted that the student has had a preparatory course in general history, with some such text as Myers or West. In this course special attention is paid to English history, and the student's work is supplemented by lectures on the development of continental Europe. Cheyney's History of England and Cheyney's Source Book are texts in the hands of the class, and special topics with library references are occasionally assigned. I and II, 6.

(2) **Medieval History.**—The student is supposed to have had courses which have given him knowledge of the great epochs in history and their



DINING ROOM.

KITCHEN.



SEWING ROOM.

relations to each other. Therefore, in this course he will take up the thorough history of one period. He will be encouraged to form his own opinions by the use of such historical sources of this period as are available in translations. In this connection the student will be given practice in application of the fundamental rules used in testing the value of historical material. I and II, 6.

(5) **American History.**—This is a course in United States history covering the period of constitutional development and with special reference to that development. The use of the library rather than any text book is required in this course, and the student is expected to spend about one-fourth of the time in the preparation of a paper on some selected subject. Course 2 should precede this course. I and II, 6.

(6) **Thesis.**—For research work in his senior year the student is allowed to select any historical subject which he is qualified to investigate; and for which some material is available either in translation or original.

Home Science.

PROF. HARKINS.
MISS BALLINGER.
MISS BROWN.

The third floor of the new agricultural building is occupied by the home science department. In the north end are two kitchens, one on either side of the hall. One, 34x26 feet, has two coal ranges, several electric stoves and desks for 16 students. The other, 27x26 feet, has one coal range and fourteen desks, fitted with individual gas stoves. All tables are well supplied with cooking utensils. Off from the east kitchen is a model dining room, and beyond it the department office. With the other kitchen is a student lunch room, 25x23 feet, connected by folding doors with the class room. There are also store rooms, pantries and cold storage rooms.

In the south end of the building is a large sewing room, 47x31 feet, with a class room, 31x16 feet, two small fitting rooms, and cases for the work of 104 students. Connected with these are two small sewing rooms, and a bed room. The department has nine sewing machines of various makes, two electric irons, cases for exhibition work, and large and small work tables.

(1) **Cooking.**—This work includes both lectures and laboratory work on the composition and preparation of foods. Lectures on marketing and care of food materials; also visits to various markets. The object of the course is to teach plain cooking—breads, meats, soups, salads, cereals, vegetables and simple desserts. Lecture 1, laboratory 3. II, 4. Miss Harkins.

(2) **Food Studies.**—This course is designed to make practical application of the science underlying the selection and preparation of foods.

The dishes prepared illustrate the scientific principles involved. Prerequisites, home science (1), chemistry (1) and (5). Lecture, 1, laboratory 3. II, 4. Miss Brown.

(3) **Household Architecture and Sanitation.**—The surroundings, situation, and plan of the house; heating, lighting, plumbing and drainage. Lectures on house plans. Each student makes the skeleton plan of a house. Lectures. II, 2. Miss Harkins.

(4) **Advanced Cooking.**—In this course menus are planned and meals prepared. For examination each student does her marketing and prepares a meal without assistance. The student also has instruction in the making of a few difficult and fancy dishes. Prerequisites, home science (1) and (2). Laboratory 2. I, 2. Miss Harkins.

(5) **Home Nursing and Invalid Cookery.**—The work in home nursing includes lectures and demonstrations by local physicians and trained nurses. Invalid cookery includes a consideration of the diet under abnormal conditions; the preparation of invalid dishes; and the dietetic treatment of certain diseases. Prerequisite, home science (4). Laboratory 2. II, 2. Miss Brown.

(6) **Dietetics.**—This course treats of the fundamental principles of human nutrition and metabolism, the relation of food to health, and the construction and preparation of dietaries. Prerequisite, home science (5). Lecture 1, laboratory 1. II, 2. Miss Brown.

(7) **Topical Course.**—Topics relating to home science are assigned and discussed. II, 2. Miss Harkins.

(8) **Teachers' Course.**—In this course both the theory and practice of teaching domestic science is given. A study is made of the courses of study in various institutions. Courses of study are planned for graded schools, high schools, and colleges. Each student has work in practice teaching. Prerequisites, home science (1), (2), (3), (4), (5), (6), and (7). I and II, 5. Miss Harkins.

(11) **Hand and Machine Sewing.**—Aprons for sewing and cooking classes will be made. There will be taking of measurements, drafting of patterns, cutting and making under-garments. The Snow system of cutting is required in (11) and (12). I, 3.

(12) **Dressmaking.**—A course of sewing applied to the making of shirtwaists and simple dresses. I, 2

(13) **Textiles.**—This course comprises a study of fabrics, beginning with their place in primitive life and tracing their development, manufacture, and economic value up to the present time. Prerequisites, chemistry (1); home science (11) and (12). I, 2.

(14) **Advanced Dressmaking.**—A wool dress or suit and a dress for afternoon or evening wear will be made . II, 3.

(15) **The Teaching of Domestic Art.**—This course deals with the relation of domestic art to education; methods of teaching domestic art;

lesson plans; courses of study; equipment; and practice teaching. Prerequisites, home science (11), (12) and (14). I, 3.

(16) **Embroidery and Dress Making.**—The first six weeks will be devoted to embroidery and crochet. Designing and making the graduating dress is a part of the work. II, 2.

Latin.

PROF. BREWER.

(1) **Virgil.**—Six books of the Aeneid are read. Metrical reading of Latin is required constantly. The students are encouraged to make metrical translations and paraphrases. Recitations. I and II, 8.

(2) **Livy and Horace.**—The special aim in this year's work, as in the previous course, is to enable the student to acquire facility in reading and a literary appreciation of the authors read. Recitations. I and II, 4.

Mathematics.

PROF. TALLMAN.
MISS BULL.

The students in this department have access to the following journals: American Journal of Mathematics (complete set); Annals of Mathematics (from 1900); Bulletin of American Mathematical Society (1898 to date); and transactions of American Mathematical Society (1898 to date), also about 200 volumes of recent treatises on mathematics. It may also be mentioned that our library is especially well equipped in treatises and journals of applied mathematics found in libraries of the engineering and physics department.

(1) **Algebra.**—Beginning with a review of radicals and quadratic equations, the course includes progressions, arrangements and groups, binomial theorem, theory of limits, undetermined co-efficients, logarithms, and an introduction to the theory of equations. I, 3.

(2) **Plane Trigonometry.**—For engineering and science students. I, 2.

(2a) **Plane Trigonometry and Logarithms.**—For agricultural and home science students. I, 3.

(3) **Analytical Geometry and Calculus.**—This course includes the geometry of the straight line and conic section coupled with the elements of differential calculus. II, 4.

(4) **Analytical Geometry and Calculus (continued).**—This course which deals largely with the differential and integral calculus also takes up some problems in analytical geometry not treated in course (3), especially the geometry of three dimensions and also includes an introduction to differential equations. I and II, 10.

(5) **Method of Least Squares.**—I, 2.

(6) **Theoretical Astronomy.**—Integration of equations of motion,

computation of orbits and ephemerides. This course should be preceded by course (5) in physics and must be preceded by course (4) in mathematics. I and II, 6.

(7) **Applied Algebra.**—This course is designed for students who do not expect to go further into the study of mathematics. Starting with a review of some of the fundamentals of elementary algebra the course deals with such subjects as ratio and proportion, mathematical inductions probable results and errors from experimental data, etc., as will assist the students in their scientific work. For agricultural and home science students. II, 2.

(10) **Differential Equations.**—Ordinary and partial differential equations with geometrical and mechanical applications. I and II, 6.

(11) **Partial Differential Equations of Mathematics - Physics.**—This course will be based on Weber's "Die Partiellen Differential Gleichungen der Mathematischen Physik," and Byerly's "Spherical Harmonics." A great many applications to concrete problems will be made throughout the course. I and II, 6.

(12) **Newtonian Potential.**—Lectures on the theory of potential, with an introduction to spherical harmonics. I and II, 4.

(13) **Algebra (Advanced)** —This course will be an extension of course (1), and will contain discussion of complex numbers, theory of algebraic functions, etc. Care will be taken to show the practical application of each subject as the work advances; that is, such subjects as the connection between complex numbers and alternating currents, etc., will be fully explained. I and II, 6.

(14) **Analytical Geometry (Advanced).**—This course is a continuation of course (3). As the time given in course (3) for geometry of three dimensions is very limited it will receive considerable attention in this course. I and II, 6.

(15) **Thesis.**—Students specializing in mathematics are required to present a thesis on some chosen subject. The subject must be chosen and approved not later than November 15 of the senior year. A great deal of work in this line is desired, as it is believed there is no better way of developing a habit of independent thought.

Only a selection of courses (10) to (14) will be given each year, those being chosen for which most students apply. The special object of our work here is to make the course in applied mathematics complete, and the work in pure mathematics will have as its object the laying of a good foundation for the more advanced work in applied mathematics. Those desiring to do work which is not offered in the above courses may consult the professor in charge of the department.

Modern Languages.

PROF. CURRIER.

The modern language department is well represented in the college library. The list includes the standard works in German and French literature in the original, as well as complete translations of the more important writers.

Many works of historical and critical nature and a number of standard lexicons may also be consulted. Several foreign language periodicals are at the disposal of students.

(1) **French.**—The study of French is begun in the freshman year, and the first year's work includes a thorough study of the elements of grammar, careful reading, with translation, of 300 pages of easy French, composition, practice in pronounciation and oral reading. Fair facility in sight reading is expected at the close of the year. I and II, 8.

(2) **French.**—In the sophomore year, in addition to easy texts and further study of grammar and composition, the classics, prose and poetry will be read, and also some scientific French, thus cultivating in the student an appreciation of the best foreign literature. The chief aim of the course is the acquisition of practical reading knowledge. I and II, 6.

(3) **French.**—An elective course in the French classic drama and nineteenth century fiction is offered to juniors and seniors. I and II, 6.

(10) **German.**—This course is open to college students who have not had high school or preparatory German. The work of the first year includes careful study of the elements of grammar, composition, pronunciation, conversation, the reading of easy texts, and sight reading. I and II, 8.

(11) **German.**—A continuation of the above course. The work consists largely of reading of a practical nature, with some introduction to the classics. Further attention will be paid to grammar and composition. If requested, scientific German will be read. I and II, 8.

(12) **German.**—The freshman work in German is a continuation of the course offered in the preparatory department, and can be taken only by students who have had two years of German previously. The classics will be studied; also, scientific texts if desired, and some attention will be given to composition and conversation. I and II, 8.

(13) **German.**—An elective course offered to those who have completed course (11) or (12). It consists chiefly of advanced reading of a practical, scientific or literary character, as the needs of the students electing it may dictate. I and II, 4.

Philosophy and Economics.

PRESIDENT HAMILTON.

(1) **Psychology.**—This course presents a general view of modern psychology and is required of all general science students. It gives a practical exposition of the materials and methods of psychological investigation. The lectures are accompanied by class demonstration. Attention is given to such topics as the growth of the central nervous system, the nature of consciousness, sensory and motory training, the higher intellectual faculties, and the will. So far as possible the work is made practical and concrete. I, 3.

(2) **Ethics.**—The work in ethics includes a study of the evolution of conduct, moral standards, the social and industrial life, the development and trend of ethical thought and an examination of utilitarianism. Required of general science students. II, 3.

(3) **Economics.**—This course consists of a study of such subjects as land, capital, labor, money, coinage, banking, rent, interest, wages, and taxation. The most important questions in economics of the present time are considered. Among these may be mentioned trusts, labor organizations, government ownership of public utilities, co-operation, recent currency, legislation, and the single tax. I and II, 4.

(4) **Sociology.**—The origin and history of human society, the various social theories and the laws of human intercourse are treated. Attention is given to such practical subjects as the government of cities, settlement work, the enrichment of country life, and charity work. Lectures and recitations. Elective, 1, 3.

Physics.

ASSISTANT PROF. HAM.
MISS BULL

The science of physics is fundamental to many of the technical studies taught in the college. Therefore the chief purpose of the following physics courses is to provide a thorough training in the science itself and in the use of the scientific method of thought, to the end that the student may have an adequate preparation for the study of the technical subjects in agriculture and engineering which are based on physical principles. The applications of the science are taught in so far as they do not interfere with the main purpose stated above.

The facilities at the disposal of the physics department are described below somewhat in detail.

The lecture room is located in the basement of the chemistry and physics building. The lecture desk is supplied with gas and both alternating and direct current circuits. A projection lantern is permanently set

up and is used constantly to illustrate the class room exercises. A large collection of lantern slides has been prepared, which cover the whole subject of physics. The apparatus for lecture demonstration has been carefully selected and is sufficiently complete for giving experimental illustrations of all the principles of the science that are usually included in college courses.

For laboratory instruction three well lighted and conveniently furnished rooms are provided on the second floor of the building.

One of these rooms is equipped for electrical measurements and is wired with both alternating and direct current circuits, conveniently arranged for experimental purposes. The galvanometers are permanently located in convenient positions. The following forms are available: tangent, astatic, Thompson, differential, Northrup, and eight forms of the D'Arsonval type, including two with ballistic suspensions. In adidtion to the above equipment the following instruments are used in the various experiments taught, viz: magnetometer, standard resistance and condensers, Carhart-Clark cells, wire and box forms of the Wheatstone bridge, Carey Foster bridge, Callendar and Griffith's bridge, rheometer, electrodynamometer, ammeters, voltmeters, Leed's potentiometer, platinum thermometer, thermocouples, earth inductor, standard solenoid, and a permeameter with ten different specimens of iron for experiments in magnetization and hysteresis.

The second laboratory is furnished and equipped for teaching mechanics and heat. The equipment includes the following: micrometer and vernier gauges, spherometer, cathetometer, balances and weights, hydrometers, Atwood's machine, Young's modulus apparatus, torsion apparatus, torsion pendulums, apparatus for resolution and composition of forces, impact, harmonic motion, principle of moments, centrifugal force, and surface tension; simple and Kater's pendulums, a laboratory clock, thermometers, air thermometer, calorimeters, expansion apparatus, hygrometers, Searles' mechanical equivalent of heat apparatus.

The third laboratory is used for the study of light and sound and also for the elementary classes in the preparatory schools. The equipment for teaching light and sound includes the following: a photometer, spectrometer, spectroscope, mirrors, prisms, lenses, diffraction gratings, optical bench, Fresnel mirror and bi-prism, apparatus for polarized light, microscope, telescope, and an Abbe refractometer, sonometers, Kundt's tubes, siren, Lissajous apparatus, and Helmholtz resonators.

For the study of radioactivity and allied phenomena, there is a large induction coil, a variety of Crookes' and X-ray tubes, Wilson electroscope, radium compounds, and other radio-active material.

The physics library is located in one of the laboratories for students' use. It contains many of the best text books and general works on phys-

ics, and the current numbers of the Philosophical Magazine, the Physical Review, Science Abstracts, Section A, and School Science and Mathematics.

(1a) **General Descriptive Physics.**—Two lectures and laboratory work two and one-half or five hours per week in mechanics, heat, light and electricity. Special attention is given in this course to the study of such physical principles as those involved in the capillary action of soils, the osmotic action of plants, the movements of winds and moisture, the causes of the deposition of dew and the prevention of frost. Physics (1a) is prescribed in the courses in agriculture and biology. Mathematics (2) or (2a) and high school physics are prerequisite. Text books, General Physics, by Crew; Laboratory Course, by Sabine; Laboratory Physics by Miller. I and II, 6 or 8.

(1) **General Physics.**—Lectures, recitations, and assigned problems, three hours per week throughout the year on mechanics, heat, magnetism, and electricity. This course is more mathematical and technical than physics (1a) and is particularly designed to meet the needs of students in engineering and the science students in the mathematics-physics course. Students who have not completed the calculus, mathematics (4), are required to take it during the same year that physics (1) is taken. Text book, General Physics, by Hastings & Beach. I and II, 6.

(2) **Physical Measurements.**—A laboratory course designed to supplement physics (1). It is strictly quantitative and is given for the purpose of providing laboratory illustrations of fundamental principles of the science and to offer a training in making measurements of precision. Text books, Mechanics, Molecular Physics and Heat, by Millikan; Laboratory Physics, by Miller. I and II, 4.

(3) **Light and Sound.**—Lectures and recitations two hours per week on wave motion, the theory of light in its application to familiar optical phenomena and to optical instruments, and on the phenomena and laws of sound. Prerequisites, physics (1) and (2). Text books, Light and Sound, by Franklin & McNutt. II, 2.

(4) **Physical Measurements.**—A laboratory course in light and sound to supplement physics (3). II, 2.

(5) **Electricity and Magnetism.**—Two lectures and two laboratory periods per week on methods for the exact measurements of resistance, electromotive force, current, capacity, and the co-efficient of self-induction. The calibration of commercial instruments, insulation testing, and magnetic measurements, such as finding the permeability and the hysteresis effects of different samples of iron, will also be included in this course. Physics (1) and (2) and differential and integral calculus are prerequisite. I, 4.

(6) **Advanced Physics.**—Physics (6) is primarily a laboratory course

and is offered as an elective to science and engineering students. Conferences and assigned reading are essential features of the course. A more complete study of the precision of measurements will be made than was attempted in physics (2) and a precision discussion will be a required portion of each laboratory report.

There are four separate parts to this course from which the work desired may be selected.

(a) **Heat**—A study of exact methods of thermometry, pyometry, calorimetry and determination of the mechanical equivalent of heat. Physics (1), (2) and (5) are prerequisite. I or II, 3.

(b) **Light and Radioactivity.**—Conferences, assigned reading and a series of standard laboratory experiments to illustrate diffraction, interference and polarization of light, spectroscopy, photometry, conduction of electricity through gases, and the phenomena of radioactivity. Physics (3 and 4) are prerequisite. II, 3.

(c) **Electricity and Magnetism.**—This course will be arranged to suit the needs and purposes of individual students. It is offered as an elective in the science and electrical engineering courses to those who wish to continue the subject beyond the requirements of physics (5). I or II, 3.

(d) **Manipulation and Construction of Apparatus.**—This is primarily a course in processes useful in the laboratory and includes glass blowing, cutting, grinding, and polishing, preparations of fibres for suspensions, silvering glass, purifying mercury and photography, including copying, printing and lantern-slide making. Practice is given in the construction and setting up of apparatus suitable for both elementary and college courses in physics. In this connection there will be conferences and assigned reading on the more recent methods of teaching high school and college physics. Physics (1, 2, 3 and 4) are prerequisite. I or II, 3.

(7) **Thesis**—Students in the mathematics-physics group who elect physics as their major subject, are required in the senior year to prepare a graduating thesis on some subject which will involve considerable laboratory work and as much originality as possible.

The Preparatory School.

MISS MARY A. CANTWELL, Principal.

The preparatory school is maintained for the benefit of the young people who live in counties not having high schools, or in the rural districts not convenient to the city high schools. With the large and well equipped kitchen, sewing rooms, shops and laboratories, the work ranks with that of the best secondary industrial schools. Many members of the college faculty give preparatory instruction in their special subjects.

For admission to the preparatory school the equivalent of an eighth grade certificate is required. Those not having eighth grade certificates will pass an examination in the common branches, or otherwise satisfy the principal before entering classes.

Military drill is required of the boys and physical culture of the girls.

A liberal course of reading is given in English classics as a part of the required work. It is desirable, so far as possible, for students to purchase the books and make them a part of their private libraries.

Judge F. K. Armstrong, of Bozeman, gives a prize of ten dollars to the one taking first place in an annual declamatory contest. There is also a prize of five dollars for the second best. Only regular students in the preparatory school are eligible to enter this contest.

Below are outlined three preparatory courses—the Scientific, as prescribed by the State Board of Education; and two industrial courses—Home Science and the Mechanic Arts. It will be noted that each of these courses includes the seven units required from all candidates for admission to college, as shown on page 14. For admission to college fifteen units of work are required; but the following courses, planned to occupy full four years, are based upon a minimum of sixteen units. A suitable diploma will be given upon the completion of any one of these courses.

A unit consists of work to the amount of four sixty-minute recitation periods per week for thirty-six weeks. Two periods of laboratory, shop work, home science, or drawing, shall count as one recitation period.

Irregular registration, except as necessitated by a student's previous work, is allowed by vote of the faculty only.

The subcourses in English, German, and Mathematics may be taken only in the order prescribed in the description of the work.

SCIENTIFIC COURSE.

FIRST YEAR.

First Semester		Second Semester	
English Composition (a)	4	English Composition (a)	4
Algebra (a)	4	Algebra (a)	4
Greek History (a)	4	Roman History (a)	4
Freehand Drawing (a)	2	Freehand Drawing (a)	2
Mechanic Arts (a) Boys	2	Mechanic Arts (a) Boys	2
Sewing (a) Girls	2	Sewing (b) Girls	2
	16		16

SECOND YEAR.

Rhetoric (b)	4	Rhetoric (b)	4
Algebra (b)	4	Plane Geometry (c)	4
Medieval History (b)	4	Modern History (b)	4
Biology (a)	3	Biology (a)	3
Freehand Drawing (b)	2	Freehand Drawing (b)	2
	17		17

THIRD YEAR.

Literature (c)	4	Literature (c)	4
Plane Geometry (c)	4	Solid Geometry (d)	4
Physics (a)	4	Physics (a)	4
German (a)	4	German (a)	4
Declamatory Practice (e)	1	Declamatory Practice (e)	1
	17		17

FOURTH YEAR.

Literature (d)	4	Literature (d)	4
Trigonometry (Math. 2a)	3	Physiology (b)	3
German (b)	4	German (b)	4
American History (c)	2	American History (c)	2
Reviews	4	Reviews	4
	17		17

HOME SCIENCE COURSE.

FIRST YEAR.

First Semester		Second Semester	
English Composition (a)	4	English Composition (a)	4
Algebra (a)	4	Algebra (a)	4
Greek History (a)	4	Roman History (a)	4
Freehand Drawing (a)	2	Freehand Drawing (a)	2
Sewing (a)	2	Sewing (b)	2
	16		16

SECOND YEAR.

Rhetoric (b)	4	Rhetoric (b)	4
Algebra (b)	4	Plane Geometry (c)	4
Biology (a)	3	Biology (a)	3
Freehand Drawing (b)	2	Freehand Drawing (b)	2
Cooking (a)	2	Cooking (a)	2
Sanitation (c)	2	Sanitation (c)	2
	17		17

THIRD YEAR.

Literature (c)	4	Literature (c)	4
Plane Geometry (c)	4	Solid Geometry (d)	4
Physics (a)	4	Physics (a)	4
German (a)	4	German (a)	4
Sewing (c)	2	The House (d)	2
	18		18

FOURTH YEAR.

Literature (d)	4	Literature (d)	4
Trigonometry (Math. 2a)	3	Physiology (b)	3
German (b)	4	German (b)	4
Cooking (b)	2	Sewing (c)	2
Reviews	4	Reviews	4
	17		17

MECHANIC ARTS COURSE

FIRST YEAR.

First Semester		Second Semester	
English Composition (a)	4	English Composition (a)	4
Algebra (a)	4	Algebra (a)	4
Freehand Drawing (a)	2	Freehand Drawing (a)	2
Mechanical Drawing (a)	2	Mechanical Drawing (a)	2
Woodwork (a)	2	Woodwork (a)	2
Forge Work (b)	2	Forge Work (b)	2
	16		16

SECOND YEAR.

Rhetoric (b)	4	Rhetoric (b)	4
Algebra (b)	4	Plane Geometry (c)	4
Medieval History (b)	4	Modern History (b)	4
Mechanical Drawing (b)	2	Mechanical Drawing (b)	2
Forge Work (c)	2	Pattern Making (e)	2
Foundry (d)	2	Machine Work (f)	2
	18		18

THIRD YEAR.

Literature (c)	4	Literature (c)	4
Plane Geometry (c)	4	Solid Geometry (d)	4
Physics (a)	4	Physics (a)	4
Mechanism (c)	3	Mechanism (c)	3
Machine (h) or Cabinet Work (g)	2	Machine (h) or Cabinet Work (g)	2
	17		17

FOURTH YEAR.

American History (c)	2	American History (c)	2
Trigonometry (Math. 2a)	3	Physiology (b)	3
Mechanism (d)	3	Mechanism (d)	3
Steam Boilers and Practice (a)	4	Steam and Gas Engines (b)	4
or Electrical Practice (a)	4	or Electrical Practice (a)	4
Machine Work (j)	3	Machine Work (j)	3
or Advanced Wood Work (i)	3	or Advanced Woodwork (i)	3
Foundry (k)	2	Foundry (k)	2
	17		17

Description of Preparatory Work.

ENGLISH.

(a) **English Composition.**—The aim of the course is to secure accurate and graceful expression, and to afford constant exercise in composition. In connection with this work English classics will be made the subject of class room study, forming a basis for the study of literature. I and II. 1 unit.

(b) **Rhetoric.**—This is a continuation of course (a) Each student is required to write at least one paper per week, based on text book work. I and II. 1 unit.

(c) **Literature.**—The object of this course is to develop an intelligent appreciation of American and English masterpieces and to promote a taste for the best literature. A series of classics similiar in number and kind to the New England College requirements are the material for critical class room study. The student will find in the library valuable works of reference. I and II. 1 unit.

(d) **Critical Study.**—The purpose of this course is to apply the principles as laid down in composition and rhetoric. It will consist of a study of the classics, writing of themes, oral discussions and library and home reading assignments. I and II. 1 unit.

(e) A one credit course in declamatory practice is offered in the third year scientific course.

The following works are studied in class: Shakespeare's Merchant of Venice, and Macbeth; the Sir Roger de Coverley Papers from the Spectator; Irving's Life of Goldsmith; Coleridge's Ancient Mariner; Scott's Ivanhoe, and the Lady of the Lake; Tennyson's Gareth and Lynette, Lancelot and Elaine, and the Passing of Arthur; Lowell's Vision of Sir Launfal; and George Eliot's Silas Marner.

MATHEMATICS.

(a) **Algebra.**—This includes the following subjects. Addition, substraction, multiplication, division, equations of the first degree with one unknown number, simultaneous equations of the first degree, factors, highest common factor, lowest common multiple, quadratic equations, simultaneous equations above the first degree, theory of indices (positive, negative, fractional, and zero), and radicals. I and II. 1 unit.

(b) **Advanced Algebra.**—Simultaneous quadratic equations; ration, proportion and variation, including graphical representation of simple relations between two variables; arithmetical and geometrical progressions; binomial theorem for positive integral exponents; logarithms, including use of tables in simple numerical work. I. ½ unit.

(c) **Plane Geometry.**—This includes, in addition to the work given in the standard texts, a large number of original exercises. Prerequisite, algebra (a). II, I. 1 unit.

(d) Solid Geometry.—In this course special attention is given to the geometry of the sphere. Prerequisite, algebra (a) and (b) and geometry (c). II. ½ unit.

SCIENCE.

(a) Elementary Physics.—Lectures with experimental illustrations, recitations, assigned problems, and laboratory work four hours per week throughout the year, in mechanics, sound, heat, light, electricity and magnetism. Text book, High School Physics, by Carhart and Chute, and Laboratory Notes, by Cobleigh. I and II. 1 unit.

(a) Biology.—This course will be conducted in such manner as to give the pupils a good understanding of the first principles of the science of living things. While the subjects of the course will be taken from the field of zoology and botany, it is not the purpose to train zoologists and botanists, but to equip the pupils, by the information and training given, to observe and interpret simple biological facts. Recitations and laboratory exercises. I and II. ¾ unit.

(b) Elementary Physiology.—An elementary course in physiology covering the main facts of general anatomy and physiology of the human body. Nutrition, the blood and circulation, respiration, excretion, nervous system and its functions, and the special senses are among the topics covered. II. ½ unit.

GERMAN.

(a) Beginning German.—The work of the first year is of the usual elementary nature, including study of grammar, composition, pronunciation, careful reading of easy texts and sight reading. I and II. 1 unit.

(b) German Readings.—The second year's work is also largely practical, but affords, as well, an introduction to classic German literature. The required reading during the two years is not less than 600 pages. I and II. 1 unit.

SEWING.

(a) Sewing.—This begins with the model work, which consists of making models in miniature, illustrating the various stitches used in general sewing and garment making. I. ¼ unit.

(b) Hand and Machine Sewing.—A continuation of model work, and practice in making plain garments. II. ¼ unit.

(c) Drafting, Cutting and Making Garments.—I. ¼ unit.

(d) Drafting Waists and Plain Skirts.—Each student furnishes her own materials, as the garments made form a part of her own wardrobe. II. ¼ unit.

HISTORY

(a) **Greek and Roman History.**—The mastery of such a text as Myer's Ancient History or a briefer text on Greek and Roman history, with supplementary work in some such simple source collection as Fling's "Greek and Roman Civilization." Special attention is paid to the geography of the ancient world, and references to other books and occasional outside topics are given to enable the students to grasp the subject rather than memorize the text. When possible, pictures of places or of objects of study are used. I and II. 1 unit.

(b) **Medieval and Modern History.**—The second year is given to medieval and modern history, using the same methods and with similar alternatives. I and II. 1 unit.

(c) **American History.**—The study of American history with special reference to the expansion of territory and the development of industrial, social and civic institutions. Lectures and textbook supplemented by the use of sources and standard reference work. I and II. ½ unit.

DRAWING.

(a) **Drawing.**—Freehand drawing from geometric solids and casts. Study of light and shade. Clay modeling. Object drawing. Study of plant forms with suggestions for their application to design. Memory and time drawing. Blackboard work frequently. I and II. ½ unit.

(b) **Drawing.**—Continuation of course (a) with increase of work in water color, wood carving, oil painting, etc. I and II. ½ unit.

COOKING AND SANITATION.

(a) **Plain Cooking.**—It is a study of breads, meats, vegetables and cereals. Two laboratory periods. I and II. ½ unit.

(b) **Cooking.**—The work is both theoretical and practical. Williams and Fisher's text book is used. One lecture. One laboratory period. I. ¼ unit.

(c) **Sanitation.**—This course covers a consideration of the house as regards its site, location, drainage, ventilation, heating, lighting and water supply. Household wastes and methods of cleaning are taken up with experiments to illustrate the principles involved. I and II. 4.

(d) **The House.**—A study of the evolution of the house; the surroundings, situation and plan of the house, heating, lighting, plumbing and drainage. Lectures on house furnishings, exercises in making skeleton plans of small houses. The text book used is The House, by Miss Bevans. II, 2.



ART STUDIO.



LIBRARY.

MECHANICAL DRAWING AND DESIGN.

(a) Mechanical Drawing.—Lettering. The shape and proportions of letters, freehand construction. Freehand sketching of simple machine parts, reproduced in detailed working drawings. Orthographic projection in the third quadrant. I and II. ½ unit.

(b) Mechanical Drawing.—A continuation of (a) in detail drawing, tracing and blue printing. Shades and shadows, isometric drawing, simple mechanical perspective. I and II. ½ unit.

(c) Mechanism.—The elementary principles of the kinematics of machinery with such applications as to be of immediate utility in shop practice; the study of gears, screws, cams, bearings and quick-return mechanism. One hour recitation; four hours drawing per week. I and II. ¾ unit.

(d) Mechanism.—A continuation of (c) in the study of bevel gears, gearing in train, roller bearings, belts and pulleys, rope and chain drive, together with tests of the strength of various materials. One hour recitation, four hours drawing per week. I and II, ¾ unit.

SHOP WORK.

(a) Wood Work.—Joinery, consisting of a series of exercises designed to develop skill in the use and care of bench tools, and proficiency in reading simple working drawings. Turning, comprising spindle, face plate and chuck work in the manufacture of simple patterns and standard articles for shop use. House carpentry, illustrating the methods and principles of framing, rafter and stair cutting, mill work and finishing. Cabinet work, in which standard wood shop machinery is used in the manufacture of drawing tables, book and filing cases, office desks and other plain furniture, and including finishing in oil, stain, wax, and varnish. Taken with mechanical drawing (a). I and II. ½ unit.

(b) Forge Work.—The operation of hand and power forges and manipulation of the fire, with progressive exercises in iron forging designed to teach the operations of drawing, upsetting, bending, forming and welding. The work of the second semester includes the forging and welding of mild and tool steels, as well as the hardening and tempering of simple hand tools. With mechanical drawing (a). I and II. ½ unit.

(c) Forge Work.—A continuation of (b) in forging and tempering hand tools, lathe tools, foundry tools, springs, drills and reamers, including annealing and case-hardening. With mechanical drawing (b). 1; ¼ unit.

(d) Foundry.—A course in bench and floor molding in green sand. Castings in white metal, brass and cast iron are poured for use in the machine shop. With mechanical drawing (b). I, ¼ unit.

(e) Pattern Making.—Instruction in the methods of making proper allowances on patterns for draft, shrinkage and finish, and practice in

the construction of patterns for pulleys, hangers, machine parts and pipe fittings, with the necessary core boxes. II. ¼ unit.

(f) **Machine Work.**—Bench work, including chipping, filing, scraping, fitting, soldering, brazing, and babbitting. Machine tool work on drill press, shaper, planer and lathe. II, ¼ unit.

(g) **Advanced Woodwork.**—Students electing this subject for the remainder of the course are given work preparing them to follow the trade of pattern-maker, cabinet-maker, or mill-wright. I and II. ½ unit.

(h) **Machine Work.**—Students choosing this subject are given advanced work on lathe, milling machine and grinder, with practice in hardening and tempering taps, dies, cutters and high speed steels. I and II. ½ unit.

(i) **Advanced Woodwork.**—A continuation of (g). I and II. ¾ unit.

(j) **Machine Work.**—A continuation of (h). I and II. ¾ unit.

(k) **Foundry.**—Advanced moulding, core making, brass furnace and cupola practice. I and II. ½ unit.

STEAM BOILERS AND ENGINES.

(a) **Steam Boilers and Practice.**—The construction and operation of steam boilers, and their auxiliaries, including the care of boilers, their strength and evaporative capacity, the physical properties of steam, combustion of fuel, pumps, injectors, feed water heaters, condensers. Prerequisites, physics, solid geometry, mechanical drawing (a), (b), and machine work (f). I. ½ unit.

(b) **Steam and Gasoline Engines.**—The construction and operation of steam and gasoline engines; valves and valve gears, governors; lubricators; indicator cards, indicated horse power, brake horse power, efficiency; belts and pulleys. Prerequisite, steam boilers (a). II. ½ unit.

ELECTRICAL PRACTICE

(a) **Electrical Practice.**—Elementary principles of electricity, electric wiring, management and care of electrical machines and apparatus, including dynamos and motors, batteries, electric lights, telephones and telegraph apparatus. Text book, Management of Electrical Machines, by Crocker and Wheeler. Prerequisites, Physics (a). Four lectures and recitations per week. I and II, 8.

REVIEWS.

Reviews—In the scientific and home science courses a review of nine weeks each is offered in arithmetic, geography, English grammar and U. S. history. I and II. 1 unit.

School of Music

EWALD SONTUM, Director.
Teacher of Piano and Violin.

MISS REGINA BARNES,
Instructor in Piano.

EARLE B. OLIVER,
Instructor in Vocal Music.

LOUIS L. HOWARD,
Director of the Band and
Instructor in Band Instruments.

ADVANTAGES OF COLLEGE INSTRUCTION.

The advantages of college over private instruction are very numerous and quite obvious to any one giving the matter serious thought. When a student is seeking the services of a private teacher, he must form his judgment as best he can on that person's fitness for his vocation, while it is certain that the teachers of a successful college are selected mainly on account of their ability, as it would not be in the best interests of such an institution to sacrifice its reputation by employing other than good teachers. Again, the stimulating atmosphere of a music school is another distinct advantage over private instruction.

The music departments are organized for a four-fold purpose:

1. To combine music and literary studies as a broad basis for regular collegiate instruction.
2. To use the art of music for intellectual, esthetic, and moral culture.
3. To teach all branches of music to special and general students.
4. To educate teachers of music.

DEPARTMENTS OF INSTRUCTION.

I. Course for the pianoforte.
II. Course for the voice.
III. Course for the violin.
IV. Course for harmony, counterpoint, analysis, and history of music.
V. Course for orchestral and band instruments.
VI. Instruction in chorus singing.

No time limit can be designated for the satisfactory completion of any course on account of difference in degree of musical ability; much also depends on the preparation made and upon the amount of time and careful attention the student can devote to the pursuit of a chosen study.

Students who present themselves as candidates for graduation must give evidence of requisite musical talent and capacity. Each student must

give, during the last year of study, one public recital, in addition to the final performance at the commencement concert. Students preparing for graduation are required to take two private lessons a week for two years, and it is necessary that resident students should study with teachers of the college for at least two years. For graduation one semester's work in rudiments and four semester's work in harmony will be required, and one year in the history of music.

The study of music has been placed upon an equality with other elective studies in the science division, and a limited number of credits may be counted toward a degree. Diplomas will be granted to students who have done satisfactory work and passed the required examinations.

CALENDAR FOR 1910—1911

The music department has divided the year into three terms or, if desired, lessons may be arranged by the college semester.

1910—Sept. 12, Fall term registration begins.
Dec. 6, Fall term closes.
Dec. 7, Winter term begins.
1911—Mar. 14, Winter term closes.
Mar. 15, Spring term begins.
June 3, Spring term closes.

PIANO DEPARTMENT.

The course in pianoforte is covered by four grades, which are known as primary, junior, intermediate, and senior. Examinations will be held twice a year—at the end of each semester. Regular students may not pass from any grade to the next without examination. While it is not obligatory for students to take these examinations, yet they are encouraged to take them because they have something definite before them, their ambition is stimulated and a better quality of study is secured. The pieces used for these examinations will be chosen from a list arranged by the director of the music department.

Special attention will be paid to the following points in the examinations:

Excellence of technique.
Accuracy of notation and correctness of fingering.
Phrasing and rhythm.
Discretion in use of pedals.
Choice of tempo and steadiness in time.
Quality of touch and tone.
Artistic interpretation.
Memory playing.
Playing at sight.

PRIMARY PIANO EXAMINATION.

Candidates must be prepared to play from memory six pieces or sonatinas selected from a catalogue of pieces.

Technic.—All scales, hands together, in quarter, eighth, and sixteenth, separately, staccato and legato; triads in all keys; arpeggios in three positions, hands separately.

Studies.—Matthews' Graded Courses, Duvernoy op. 176, and Loeschhorn op. 65, or their equivalents.

JUNIOR PIANO EXAMINATION.

Candidates must be prepared to play from memory eight pieces selected from the catalogue, one number of which must be by Bach One number of the eight must be prepared without assistance.

Technic.—All scales, hands together, in quarter, eighth, and sixteenth, notes, metronome at 69. Triads and four-note chords with different touches. Arpeggios formed on all major and minor triads with their inversions, metronome at 84, hands separately. Staccato octaves in any scale required.

Studies.—Czerny-Germer studies, Vol. I and II; studies arranged by Franklin Taylor; Heller, op. 45, 46, 47; Bach, Twelve Little Preludes and Inventions. Sonatinas and sonatas by Kuhlau, Clementi, and Dussek.

INTERMEDIATE PIANO EXAMINATION.

Candidates must be prepared to play from memory eight pieces selected from the catalogue, one number of which must be by Bach, one by Beethoven, and one by Chopin or Schumann. One number of the eight must be prepared without assistance.

Technic.—Major and minor scales, hands together, similar and contrary motion, metronome at 105. Also major scales, hands together, in thirds, sixths, and tenths, metronome at 100. All chord forms. Arpeggios formed on the major and minor chords and on the diminished seventh chords, with inversions, metronome at 92 Staccato octaves in major and minor keys, hands together.

Studies.—Hassert, op. 50 Vol. I and II; Cramer, studies; Bach, preludes and fugues; Loew, octave studies; sonatas by Beethoven, Haydn, and Mozart.

SENIOR PIANO EXAMINATION.

Candidates must be prepare to play from memory eight pieces selected from the catalogue, one number of which must be by Bach, one by Beethoven, and one by Chopin or Schumann. One number must be a concerto. One number of the eight must be prepared without assistance.

Technic.—All major and minor scales in octaves, tenths, sixths, and thirds, metronome at 120. Scales must also be played with crescendos and diminuendos, two notes against three, and three notes against four. All chord forms, solid and broken, with any touch required. Arpeggios formed on all major and minor chords, also the dominant seventh, and diminished seventh chords, all with inversions, metronome at 108. All octave forms will be required.

Studies.—Etudes by Chopin and Haberbier; Bach, Well Tempered Clavichord; Clementi, Gradus ad Parnassum; Kullak, Octave Studies. Book II.

TUITION

(Payable in Advance)

With Mr. Sontum.

For one forty-five minute lesson per week for one term.....$25.00
For two half-hour lessons per week, for one term 32.00

With Miss Barnes

For one forty-five minute lesson per week, for one term.....$13.50
For two half-hour lessons per week, for one term.. 18.00

Tuition fees are subject to change from year to year.

Piano rent.—One hour each day, 30 cents per week.

Two hours each day, 50c per week.

Regulations.—No reduction will be made for temporary absence from lessons or for lessons discontinued. Lessons missed by the teacher will be made up at the mutual convenience of teacher and pupil.

All students who take work in music shall ordinarily be enrolled in at least twelve credits of work (including, if so assigned, work in harmony and musical history) in addition to the work in vocal and instrumental music. Students residing at home may be excused by the faculty from such requirements upon the request of their parents. Work is recommended in home science, language, literature, history and art.

All students not candidates for a preparatory diploma or a college degree, who are taking music in combination with other work of the college shall be registered by the head of the department of home science.

All students must attend all regular meetings of the students' musical club and all public recitals.

The department is closed on the college and national holidays. Lessons falling on these days will not be made up.

HARMONY AND HISTORY

For the five semester's work required for graduation, Jahassohn's and Anger's Manuals of Harmony are used. A thorough drill is also given in notation—notes and rests, the staffs, clefs and ordinary musical signs;

intervals, time, scales, transposition; and definition of musical terms. Students are trained to play cadences, sequences and modulations upon the piano. Matthew's Popular History of Music will be used for one year.

FEES.

Harmony—$15.00 for the entire academic year, (one lesson a week).
History—$15.00 for the entire academic year, (one lesson a week).

VOCAL DEPARTMENT.

The purpose of this department is to equip students for teaching and public singing. The solid foundation is laid by means of the Italian method. Italian sounds are used from the beginning as more conducive to free and natural tone production. The student is trained to a right appreciation of this and to comprehension of breath control and direction, as the only sure guides to success.

Candidates for graduation must have completed a high school course or its equivalent, four years' voice work, one year each of Harmony, History of Music, Solfeggii and Normal Methods, must have some knowledge of modern languages and be able to play accompaniments.

The final examination shall consist of the singing from memory of an aria in a foreign language with not over two weeks' preparation, in addition to which the student shall give at least one recital and take part in the graduating program.

Technique studies and songs of the four years course are carefully graded and selected to meet the needs of the individual student. Some of the more important authors and composers are the following: Panorka, Abt, Sieber, Concone, Nora, Lutgen, Viardot, Marchesi, Bona, Aprile, Vaccai, Vannichini, Tosti, Cowen, Chaminade, Mercadenti, Pinsuti, Donizetti, Rossini, Handel, Haydn, Mozart, Brahms, Schubert, Schumann, Franz and Verdi.

TUITION

(Payable in Advance)

One forty-five minute lesson per week for one term...$18.00
Two half-hour lessons per week for one term... 25.00

Pupils wishing to arrange for instruction by the single lesson instead of by the term will be charged $1.50 per lesson.

No reduction will be made for any pupil who enters late in the term, or for temporary absence, or for withdrawal before the end of the term. In case of protracted illness ,arrangements may be made at least a day before the lesson period.

VIOLIN DEPARTMENT.

For beginners the First Part of the Violin Schools by either Louis Schubert, Carl Henning, Edm. Singer, or Herman, is used, and, when neces-

sary, there are introduced easy arrangements of melodious pieces for violin with piano accompaniment, such as Melodien Sammlung, by H. Urban, etc., selections from easy duets for two violins, by Pleyel or Mazas. This is followed by Part II of Henning's Violin School, Kross' scales in two octaves; Studies, by H. E. Kaysor, op. 20, or first part of Gradus ad Parnassum, by Jacques Dont; and easy solos, by Allard, Herman, de Beriot and others. Compositions for violins and piano are introduced as soon as practicable. Selections from the following are made according to the ability of the student: Dussek's Sonatas for piano with added violin part; sonatas for piano and violin by F. Schubert, Hauptmann, Haydn, and Mozart; Beethoven's Serenade op. 8, arranged for piano and violin, etc. Later, Part III of Henning's Violin School; Scales in Three Octaves, by Fischel, Schradiesek's Violin Technic and Tonleiterstudien; the studies of Kreutzer, Fiorillo, Rovilli and Rode; Concertos, by Viotti, or Rode; Solos by David, Allard, DeBeriot; Duetos, by Viotti or Spohr. Lastly the 24 Etudes, by Gavine, Allard's 10 Etudes Artistique op. 19, and Abel's adaptation for the violin of Cramer's Famous Piano Studies; Concertos, by Mendelssohn, Beethoven, Spohr, Molique and Max Bruch; Sonatas for the violin, by Bach; Solos by Vieuuxtemps, Ernst, Wieniawski, Sarasate and other modern composers.

ENSEMBLE

In this department, sonatas for piano and violin by Bach, Beethoven, Mendelssohn, Schumann, Mozart, Haydn, Schubert, Grieg, Rubinstein and others are used; also many classical compositions of different forms. This department is open to advanced piano students only.

TUITION

(Payable in Advance)

One hour lesson per week, for one term$23.00
Two half hour lessons per week, for one term... 23.00
One forty-five minute lesson per week, for one term..... 17.00

Terms—For ensemble with violin same as for violin lessons.

Regulations—Same as for piano department.

RECITALS

Frequent instrumental and vocal recitals are given by members of the faculty and students, the latter being thus enabled not only to cultivate their taste by hearing the best composers interpreted by the advanced students, but to develop their own powers of performance to the fullest extent.

Pupils studying in the elementary grades, are encouraged to play at

the junior recitals, as soon as they are grounded in the primary requirements of touch, phrasing and conception.

Ensemble Class.—At the beginning of each year, ensemble classes are arranged. Students will find these classes very desirable and helpful, not only because they afford an opportunity of becoming better acquainted with the literature of concert music, but also because they insure a steadiness in playing and inspire confidence.

College Choristers.—This glee club consists of eighteen members under the leadership of Prof. Oliver. Students who have suitable voices for singing and who read music with sufficient facility are admitted. The club meets twice a week, preparing standard choruses and part songs from the classical and modern composers, which are given publicly from time to time.

School of Art.

MRS. MARSHALL
MRS. GAGE
MISS KOUNTZ

The art department has a good equipment of casts and busts, masks, parts of the human figure, ornament and geometric solids; benches and tools for wood carving and clay modeling, a kiln for china firing, a perforating machine for transferring designs for embroidery, and photographic copies of sculptures and world pictures. There is also a splendid selection of books on art.

This work is intended to famaliarize the student with the principles that underlie art, as well as with the practice of the various forms of art, chosen according to the taste of the student. Lectures are given on the principles and history of art, but the teaching is entirely individual. Among the forms of work offered are drawing, with attention to grouping, light and shade, perspective, clay modeling, wood carving, decorative designing, china painting, art embroidery; painting in oil or water colors, sketching from nature, figure study.

That the study of drawing is important in education is now universally acknowledged. Aside from the advantage to engineers, machinists, and architects, of a practical knowledge of draughtsmanship, the psychologic value of a knowledge of drawing is very great. The chief object of education is the quickening of the powers of the mind. Drawing brings out the power of analysis, habits of observation, qualities of judgment, imagination, memory and taste. It is something more than mere training of the eye. To achieve even moderate success requires that thought be put into every line. A line put down without thought is always a wrong line.

Art, aside from anything we can produce, helps us to appreciate the work of great artists and opens our eyes to the beauty of form and color in nature. It extends our powers of enjoyment and gives us a better understanding of the history of the human spirit. It gives a proper gratitude for the work of great artists.

Students who are registered in the art course are admitted without further tuition fees to such other work of the college as their preparation will permit them to pursue to advantage. Attention is called in this connection to the work offered in history, literature, language, home science, music (which is charged separately), and in engineering and mechanic arts.

The art course, as here outlined, will indicate the work of the average student in a four year's course planned for those who attend mainly for the art work. All the teaching being individual, the student is carried forward just as rapidly as his own talent and industry will permit.

Every effort is made to teach correct drawing. The pupil is then encouraged to apply such knowledge in any direction in which his talents may seem to lie, and is allowed the use of various mediums, such as oil, water color, pastel, etc., and also may take lessons in china painting. The classes in drawing and wood carving are open to students in any of the college courses.

Attention is called to the regulation printed on page 17, regarding work done suitable for exhibition purposes.

FRESHMAN YEAR.

Drawing.—Drawing from the cast, in charcoal or crayon. Still life and object drawing. Drawing from plants and other natural forms in preparation for design. Sketching from nature, in the last few weeks of the second semester. In object drawing the pupil is required to study artistic grouping and good arrangement of light and shade. Memory and time drawing and blackboard work will be carried through the year.

Perspective.—Perspective and its practical application to the drawing of buildings, and to sketching from nature. Perspective problems to be worked out and carefully drawn. Water color tinting for mechanical work. Several art lectures each week. Clay modeling may be studied at the discretion of the teacher.

SOPHOMORE YEAR.

General Principles of Design.—Color schemes and color harmony. Historic ornament. Each student will occasionally be required to submit original design for embroidery, wood carving and other decorative work, based upon plant forms which he has drawn during previous years.

Painting.—The painting of plants and still life in oil or water color. Pen and ink drawing. Sketching from nature as the weather will permit.

JUNIOR YEAR

Wood Carving.—An extended course in carving as applied to furniture and other objects. Lectures on the history of wood carving.

Figure Study.—In this year there is a life class, open to all who show talent for figure drawing. Study of costume. Painting in oil and water color. Lessons on decorations of interiors.

SENIOR YEAR.

Any branch of art preferred by the student. Otherwise further instruction in branches already begun. China painting may be taken up at the discretion of the teacher.

School of Agriculture.

The great majority of the young men in the rural communities finish their education in the common schools. They have had little or no opportunity to become acquainted with the science underlying farm work. The young men who expect to become farmers are cordially invited to enter the course in the school of agriculture. The aim is to educate the student toward the farm and to develop a love for farm life by showing the possibilities of scientific agriculture.

The course extends through three years of six months each and comes in the winter season when the young people can be spared from farm work. For entrance to this course, a student must have finished the 8th grade of the common schools or its equivalent. Those who satisfactorily complete this course will be given diplomas. The general fee of $6.00 is charged. A laboratory fee of $2.00 is required in dairying and chemistry, and $1.00 in biology. The shop deposit is $4.00 per year.

Below is the outline of the course. The names and letters in the parentheses refer to the description of the work which follows the outline.

COURSE IN SCHOOL OF AGRICULTURE.

FIRST YEAR

First Semester		Second Semester	
English Composition (Eng. f)	2	English Composition (Eng. f)	3
Botany (Biology b)	4	Farm Mechanics (Agron. f)	3
Elementary Physics (Physics b)	3	Physics (Physics b)	3
Carpentry (Mech. Arts a)	2	Carpentry (Mech. Arts a)	2
Nursery Practice (Hort. a)	3	Vegetable Gardening (Hort. b)	3
Animal Types (An. Ind. a)	3	Breeds of Livestock (An. Ind. b)	3
Farm Dairying (Dairy a)	3	Crop Production (Agron. a)	4
	20		20

SECOND YEAR

Rhetoric (Eng. g)	2	Rhetoric (Eng. g)	2
Elem. Chemistry (Chem. a)	3	Elem. Chemistry (Chem. a)	3
Field Crops (Agron. b)	4	Soil Physics (Agron. c)	3
Orcharding (Hort. c)	4	Plant Diseases (Biol. c)	4
Poultry (An. Ind. e)	3	Forge Work (Mech. Arts b)	2
Mechanical Drawing (a)	2	Vet. Physiol (Vet. Sc. a)	3
Forge Work (Mech. Arts b)	2	Milk & Milk Testing (Dairy c)	3
	20		20

THIRD YEAR.

Literature (Eng. b)	2	Literature (Eng. h)	2
Economic Entomology (Biol. d)	4	Economic Entomology (Biol. d)	4
Principles of Breeding (An. Ind. d)	4	Livestock Feeding (An. Ind. c)	4
Common Diseases (Vet. Sci. b)	3	Obstetrics (Vet. Sci. c)	3
Landscape Gardening (Hort. d)	3	Cheese Making (Dairy b)	3
Soil Fertility (Agron. d)	3	Farm Management (Agron. e)	3
	19		19

Intermediate Course.

Any student who has finished the school of agriculture course may enter the freshman year of any college course by completing the nine additional units of preparatory work described below. The length of the semester is the same as in the preparatory school—18 weeks.

FIRST YEAR.

First Semester		Second Semester	
English (b)	4	English (b)	4
Algebra (a)	4	Algebra (a)	4
History (a) or (b)	4	Geometry (c)	4
German (a)	4	German (a)	4
Physics (a)	4	Physics (a)	4
	20		20

SECOND YEAR

English (c)	4	English (c)	4
Algebra (b)	4	History (a) or (b)	4
Geometry (c)	4	Geometry (d)	4
German (b)	4	German (b)	4
	16		16

EQUIPMENT

Students in this course have the advantage of a modern dairy in operation, a complete poultry plant with several of the best breeds, modern grain and soil laboratories, model farm buildings and barns, with pure bred live stock, the experiment station farm, green houses and orchards, the large biological, chemical and physical laboratories, and the well equipped wood and iron shops of the engineering department. The methods employed are practical. The instruction is supplemented with practice in the laboratories, the dairy, the orchards, the greenhouse, and with the herds. Visits are also made to other farms and herds in the neighborhood.

AGRONOMY

(a) Crop Production.—This course includes a study of the principles underlying, and the factors influencing reproduction, germination, and growth in agricultural plants. II, 4.

(b) Field Crops.—A study of the various classes of farm crops, their history, cost of production, consumption, products and by-products. In this course some time is devoted to the judging of grains. I, 4.

(c) Soil Physics.—A review of the origin, formation and classification of soils, and a careful study of the conditions influencing the supply of heat, and air and moisture as related to growing plants. II, 3.

(d) Soil Fertility.—Maintenance of fertility, fertilizers and rotation. The influence of manure and the effect of the different crops upon the productive capacity of the soil and upon succeeding crops. I, 3.

(e) **Farm Management.**—This course considers the business side of farming as an industry, also the relation of farming to the other industries. II, 3.

(f) **Farm Mechanics.**—A study of the construction, function and methods of operating, adjusting and repairing implements and machinery; also a study of the care and management of farm motors. II, 2.

ANIMAL INDUSTRY.

(a) **Animal Types.**—Study of types as related to production and work. Three types of cattle, the dairy, beef and dual purpose; the market classes of horses, the bacon and lard types of hogs, and the mutton and wool types of sheep. I, 3.

(c) **Live Stock Feeding.**—In this course students are taught how to make rations for the different classes of animals and how to feed for best results. He is taught those things that are necessary to make him a successful live stock farmer. Attention is given to preserving, storing and preparing the various fodders, roots and grains produced on the farm.

(d) **Principles of Breeding.**—This course includes a study of the laws of heredity, correlation, reversion, variation, fecundity, methods of breeding, crossbreeding, selection, etc. I, 4.

(e) **Poultry.**—Type and management. Feeding and care of poultry. I. 3.

(f) **Veterinary Science.**—The work in veterinary science consists principally of the study of the different diseases most commonly affecting farm stock, with special reference to diagnosis and treatment. I and II, 8.

DAIRYING.

(a) **Farm Dairying.**—The study of dairying as related to the farm; the care of cows; the production of sanitary milk, and the handling of milk for the creamery and city delivery; the construction of milk houses and stables; the advantages of the hand Babcock tester on the farm and the making of the test; a comparison of the gravity and hand separator methods; how to set up and care for the separator so as to get the best results. An opportunity is afforded to study and compare all the leading makes of hand separators. Butter making takes up the practical methods to be employed on the farm for the ripening of the cream, the churning, packing and marketing of butter. I, 3.

(b) **Cheese Making.**—The making of cheddar cheese on the farm. This comprises a study of the care of the milk for cheese making, the process of manufacture, and the curing and marketing. Some work is given also in creamery accounts, with particular reference to the paying for milk or cream at the creamery, and the general handling of the business end

of the creamery, to fit young men for co-operative creamery managers and secretaries. II, 3.

(c) **Milk and Milk Testing.**—Practical work is given in testing cows, as well as milk and all of its products, so that the student may have a clear conception of the relative value of the different breeds of cattle in the production of milk, cream, cheese and butter. This course also comprises a practical study of milk, its production and uses, with especial reference to sanitary methods of handling for city milk trade, creamery and cheese factory. II, 3.

HORTICULTURE.

(a) **Nursery Practice.**—This course deals with the propagation of fruit and ornamental plants for both home and commercial purposes. The work is given in lectures, text book, and practice in the laboratory and green house. I, 3.

(b) **Vegetable Gardening.**—The methods of growing vegetables in the field and under glass, hot bed constructing and management, and the marketing and gathering of vegetables are treated in lectures, text books and practice in the field and green houses. II, 3.

(c) **Orcharding.**—The growing, harvesting and marketing of trees and small fruits are studied. Special attention is given to the methods of culture and varieties adapted to Montana conditions. The experiment station orchard offers good opportunities for student work in fruit growing. I, 4.

(d) **Landscape Gardening.**—In this course particular attention is given to the study of plans for laying out and planning farm homes. The trees, shrubs, and flowering plants suitable for Montana conditions are studied with methods of propagating and growing them. I, 3.

BIOLOGY

(b) **Botany.**—Three recitations and one laboratory period per week. The elements of botany are taken up, especially with a view to the needs of agricultural students. The classification, structure, physiology and ecology of plants are briefly covered. I, 4.

(c) **Plant Diseases.**—Two recitations and two laboratory periods per week. So far as possible in the limited time available the diseases of the various agricultural and horticultural plants will be studied. This work is conducted upon a scientific basis but at all times the needs of the practical agriculturalist are kept in view. II, 4.

(d) **Entomology.**—Three recitations and one laboratory period per week. After a very brief survey of the animal kingdom, the anatomy, physiology, habits, transformations, and classification of insects are studied, together with the methods for controlling injurious species. This course is designed, in a comprehensive manner, to prepare the student

for defense against the various insect pests of the farm, orchard and garden. I and II, 8.

CHEMISTRY AND PHYSICS

(a) **Elementary Chemistry.**—Lectures with experimental demonstrations, recitations and laboratory work on the fundamental principles of chemistry, the occurrence, preparations and uses of the common elements and their compounds. The applications of chemistry to agricultural problems will be frequently pointed out. Text book, Remsen's Elements of Chemistry. I and II, 6.

(b) **Elementary Physics.**—Experimental lectures, recitations and assigned problems, three hours per week, on topics selected from mechanics, heat, light, electricity, and magnetism. Emphasis is placed upon those subjects which either have a direct application to agricultural problems or are desirable as a preparation for some subsequent study in the course. The lectures are illustrated with numerous experiments and lantern slides. It will be from properly interpreting the class room exercises and from the working of many practical problems that the student will derive the most benefit. Carhart and Chute's High School Physics will be used as a text book. I and II, 6.

ENGLISH.

(f) **English Composition.**—The first year is devoted largely to practice in the simpler forms of composition. Attention is given to business forms, letter writing, narration, and to the forming of habits of correct speech. I and II, 5.

(g) **Rhetoric.**—During the second year more advanced work is given in composition, with frequent essays, reviews, etc. A few masterpieces are studied as a basis for style of expression. I and II, 4.

(h) **Literature.**—The third year gives a comprehensive study of English and American literature. The object is to develop an appreciation for the works of standard authors and a taste for the great masterpieces of the language. I and II, 4.

MECHANIC ARTS.

(a) **Carpentry.**—The use and care of carpenter's tools. A series of exercises in joinery, followed by practice in framing, rafter and stair cutting, and such other plain carpentry as will be of utility on the farm. I and II, 4.

(b) **Forge Work.**—The care and manipulation of the fire, iron forging, including the operations of drawing, upsetting, pointing, bending, welding, calculation of stock. Implement repairs, plow pointing, manufacture of chains, hooks, clevises, clips, etc. Steel forging, hardening and tempering cold chisels, hardies, punches, cold cutters, etc. I and II, 4.

School of Pharmacy.

PROF. MOLLET.

This school offers two and three-year courses which afford a thorough training in all branches of pharmacy and pharmaceutical chemistry. These courses lead to the degree of pharmaceutical chemist (Ph. C.), and qualify the graduate who has had the required practical experience to meet the examination given in any state for the position of registered pharmacist.

The two-year course requires two full academic years for completion and provides the foundation in chemistry and pharmacology as applied in the various pursuits of the profession of pharmacy.

The three-year course includes the same subjects in chemistry and pharmacy and affords the student an opportunity of extending his pharmacy education with advantage, over a period of three years. This course is especally recommended to applicants who are not high school graduates, or otherwise well qualified to pursue the two-year course.

Candidates for admission must be at least eighteen years of age, unless they are graduates of accredited high schools, or of schools maintaining courses of equal length and rank, and may be admitted: (a) by presenting a certificate of graduation from an accredited high school; (b) by presenting a certificate from an accredited high school, signed by the principal or superintendent, showing that not less than one year of work has been completed; (c) by an examination on an equivalent amount of work in subjects designated by the college; (d) by faculty approval of grades from other than accredited high schools.

Notice is hereby given that the requirements for these courses will be raised in the future.

Applicants who furnish the regular college entrance requirements, fifteen units, and complete sixty credits of approved work in the college in addition to those outlined in the two-year course may receive the degree, Bachelor of Science (B. S.) in Pharmacy.

While it is not compulsory, it is advised that students have one or two years practical training in a drug store before entering.

In addition to the annual tuition fee of $12.00, deposits are required as indicated on page 13.

The students have access to such of the chemical and botanical laboratories as the work calls for, as well as those of pharmacy and materia medica. Those laboratories contain all the modern equipment necessary for the proper instruction of the students. Free access is also granted to the standard reference books in the several branches of science, and the magazines and journals of chemistry and pharmacy.

Lectures will be given throughout the course on chosen subjects, by those who have gained prominence in pharmaceutical pursuits, and in the

sciences closely related to pharmacy. All pharmacy students will be required to attend these lectures, for which a credit of one hour is given for the semester.

All regular students will be required to keep notes on the work done, and present the same for examination and rating. Oral and written quizzes will be given during each course, and a final written examination at the close of the senior year covering the entire course of instruction in pharmacy. This examination will resemble in every respect those given by the state boards of pharmacy.

This school was officially recognized by the State Board of Pharmacy, April 12, 1910, and graduates, upon payment of the regular fee, may receive their certificates of registration without examination, as follows: Those furnishing satisfactory evidence to the Board of having had one year of practical experience in a drug store, may become Assistant Registered Pharmacists, and those having had four years practical experience, may become Registered Pharmacists.

PHARMACY.

Three Year Course.

FIRST YEAR

First Semester		Second Semester	
English (1 or b, c or d)	2 or 4	English (1 or b, c or d)	2 or 4
Introductory Pharmacy (Phar. 1)	4	Official Galenical Phar. (Phar. 3)	4
Pharmaceutical Problems (Phar. 2)	2	Pharmacy Laboratory (Phar. 4)	2
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
	12 or 14		12 or 14

SECOND YEAR.

Qualitative Analysis (Chem. 2)	4	Quantitative Analysis (Chem. 3)	4
General Botany (Biol. 9)	5	Plant Phys. and Hist. (Biol. 10)	1
Pharmacy Latin (Phar. 12)	4	Physiology (Biol. 3)	5
		Pharmacognosy (Phar. 5)	3
	13		13

THIRD YEAR.

Organic Chemistry (Chem. 8)	2	Physiological Chem. (Chem. 2)	3
Bacteriology (Biol. 12)	2	Microscopical Study of Powdered Drugs (Phar. 7)	2
Pharmacopoeial Salts (Phar. 6)	5	Materia Medica, Therapeutics and Toxicology (Phar. 9)	5
Pharmacopoeial Testing and Drug Assaying (Phar. 8)	3	Prescription Reading and Dispensing (Phar. 10)	2
	15		12

Two-Year Course

FIRST YEAR

General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
General Botany (Biol. 9)	5	Plant Phys. and Hist. (Biol. 10)	1
Introductory Pharmacy (Phar. 1)	4	Physiology (Biol. 3)	3
Pharmaceutical Problems (Phar. 2)	2	Official Galenical Phar. (Phar. 3)	4
Pharmacy Latin (Phar. 12)	4	Pharmacy Laboratory (Phar. 4)	2
		Pharmacognosy (Phar. 5)	3
	19		17

SECOND YEAR.

Organic Chemistry (Chem. 8)	5	Quantitative Analysis (Chem. 3)	4
Qualitative Analysis (Chem. 2)	4	Physiological Chemistry (Chem. 2)	3
Bacteriology (Biol. 12)	2	Microscopical Study of Powdered Drugs (Phar. 7)	2
Pharmacopoeial Salts (Phar. 6)	5	Materia Medica, Therapeutics and Toxicology (Phar. 9)	5
Pharmacopoeial Testing and Drug Assaying (Phar. 8)	3	Urine Analysis (Phar. 11)	1
		Prescription Reading and Dispensing (Phar. 10)	2
	19		17

School of Pharmacy.

(1) **Introductory Pharmacy.**—The course consists of a thorough study of the theory of pharmacy; the authoritative guides and the use of pharmaceutical apparatus; a systematic study of the subjects of weight, measure, specific gravity, specific volume, and percentage solution; and all the common processes in pharmacy. Lectures and recitations, 3; laboratory, 1. I, 4.

(2) **Pharmaceutical Problems.**—Two hours per week devoted to the application of the principles of pharmaceutical arithmetic and to practical problems involving weights, measures, specific gravity, specific volume, percentage solution; and to recitations. I, 2.

(3) **Official Galenical Pharmacy.**—A continuation of course (1) and must be preceded by it; consisting of a thoroughly scientific study of the galenical preparations in the United States Pharmacopoeia and National Formulary. These are carefully considered with regard to classification. Technical nomenclature, mode of preparation, preservation, and percentage composition of each individual preparation. Texts, U. S. Pharmacopoeia, eighth revision, and National Formulary, third edition. Lectures and recitations. II, 4.

(4) **Pharmacy Laboratory.**—A practical laboratory course in which many of the important and difficult medicinal preparations of the U. S. Pharmacopoeia and National Formulary are manufactured by each student, especially the typical representatives of each class of galenicals, such as waters, tinctures, fluid extracts, spirits, elixirs, pills, suppositories, ointments, etc. Neatness, accuracy, quantity and quality of work done will determine the student's standing. II, 2.

(5) **Pharmacognosy**—A study of the natural history and important features of crude drugs; the means of identification and selection; constituents, and official preparations. The official organic drugs and some of the commonly used non-official ones will be studied in the following order: (a) Plant drugs—Roots, rhizomes, tubers, bulbs, leaves and leaflets, herbs and flowers, fruits and seeds, gums, resins, balsams, etc.; (b) Animal drugs. The student has actual access to the typical specimens in the materia medica laboratory. Lectures, recitations, and laboratory exercises. II, 3.

(6) **Pharmacopoeial Salts.**—The official inorganic and organic salts, acids, and the official alkaloids, alkaloidal salts and glucosides are studied with special reference to nomenclature, source, manufacture, physical and chemical properties. Lectures and recitations. I. 5.

(7) **Microscopical Study of Powdered Drugs.**—This course consists of the study of powdered vegetable drugs and their common adulterants by the aid of the microscope. By the preparation of slides and drawings the student learns the most important characteristics of the different drugs most commonly adulterated and their common adulterants, and is

thus enabled to determine questions of identity and purity. Laboratory 2. II, 2.

(8) **Pharmacopoeial Testing and Drug Assaying.**—This is a practical laboratory course in the analysis and standardization of the inorganic medicines, chemicals, organic drugs and preparations, according to the methods of the United States Pharmacopoeia. Recitations and laboratory work. I, 3.

(9) **Materia Medica, Thereapeutics and Toxicology.**—Lectures and recitations on the physical, physiological and therapeutic properties of medicines, together with their therapeutic classification and dosage. Special attention is also given to the physiological action, methods of detection, antidotes and toxic posology of the more commonly used potent remedies. II, 5.

(10) **Prescription Reading and Dispensing.**—This course consists of technical study of all phases of the prescription, practical exercises at sight reading, and in the art of extemporaneous compounding. II, 2.

(11) **Urine Analysis.**—Two and one-half hours per week devoted to the study and estimation of the constituents of urine in health and disease. Fee, $1.50. II, 1.

(12) **Pharmacy Latin.**—An elementary course in Latin syntax, with a study of Latin pharmaceutical terms. I, .4

ONE YEAR COURSE IN HOME SCIENCE.

This course is intended for young women who are not prepared to do college work but who wish systematic instruction in Home Science. Applicants must have completed the eighth grade in the common schools. No irregular students will be registered. The work is necessarily more elementary than in the longer course. Music may be substituted for biology or art. A diploma, crediting the student with one year's work, is given upon the satisfactory completion of the course.

First Semester.		Second Semester.	
English Composition (a, b, or c)	4	English Composition (a, b, or c)	4
Sanitation (c)	2	Sanitation (c)	2
Sewing (e)	4	Sewing (e)	4
Freehand Drawing (a or b)	2	Freehand Drawing (a or b)	1
Biology (a)	3	Biology (a)	3
Cooking (e)	4	Cooking (e)	3
		The House (d)	2
	19		19

Note: See preparatory school for sub-courses in English, sanitation, art, biology, and "the house."

(e) **Cooking.**—The work is both theoretical and practical. The object is to teach plain cooking, breads, meats, eggs, cereals, salads, soups, preserving fruits, and simple desserts. Much attention is given to serving meals. The Elements of the Theory and Practice of Cooking, by Williams

and Fisher, is used. One lecture and three laboratory periods during the first semester and three laboratory periods during the second semester. I and II, 7.

(e) Sewing.—In the first semester drills on making different stitches and seams are given. Drafting and making underwear. In the second semester, drafting, cutting and making plain waists and skirts. Two shirt waists, a wool skirt, and the graduating dress must be made. I and II, 8.

HORSE SCHOOL.

January 23 to 29, 1911.

Lectures will be given on how to feed and improve the horse; the laws of heredity will be discussed and it will be shown by horses affected with ring bones, spavins, roaring, etc., should not be used for breeding purposes and why pure breds are the most valuable breeders.

Lectures and demonstrations will be given on how to diagnose and treat common ailments as colic, azoturia, ring bones, side bones, etc.

Judging will be given every day with horses in the judging pavilion.

POULTRY SCHOOL

January 30 to February 4.

A short poultry course of one week will be given, January 30 to February 4, 1911, for the benefit of the men and women interested in this line of work. The work will consist of lectures on types, breeds, housing, feeding, incubation, brooding, breeding for egg production and for standard fowl; fattening, preparation for market, caponizing, diseases, and general care and management of poultry. The work will be carried on at the college poultry plant where the practical application of these principles can be observed. It is the aim to make the course as full and as practical as is possible in such a short time.

FOUR WEEKS' CREAMERY COURSE.

February 6 to March 4.

Beginning just after the poultry course for farmers there will be a four-weeks creamery course, running from February 6 to March 4, 1911. There is a demand for butter makers in the state, and this course has been designed to fit young men to fill these positions. The course will last four weeks and all of the student's time will be spent in the college creamery doing the actual work on the dairy floor. By this means he will be brought in touch with the problems of the average factory. In addition to the creamery practice ,two lectures will be given each day, dealing with subjects which cannot be taken up in practice on account of the short time allowed for this work. On the last day a final examination will be held. By this means as well as by the student's work in the creamery, it will be possible to judge of his ability to fill available positions.

Alumni.

Allen, Elbert, B. S., 1903; Attorney at Law, Livingston, Montana

Alward, Mary L., B. S., 1908; Teacher in Pony Public Schools, Pony, Mont.

Baker, Harold E., B. E E., 1907; Operator or Assistant Engineer, Butte.

Benton, Ralph, B. S., 1906; Instructor in Entomology, College of Agriculculture, University of California, and Assistant Entomologist in charge of Apiculture, California Experiment Station, Berkeley, California.

Blankenship, Hon. E. V., B. S., 1897; Yellowstone Park Transportation, Farming and Stock Raising, Bozeman, Montana.

Bole, William S., B. S., 1906; Medical Student at Johns Hopkins Uuiversity, Baltimore, Md.

Breneman, Annie T., B. S,. 1907; Teacher in Eighth Grade, Bozeman, Mont.

Brewer, Lucile, B. S., 1909; Dietitian, University of Montana, Missoula, Montana.

Brown, Edith E., B. S., 1904; Teacher of Pianoforte and Theory, Regina, Sask., Canada.

Bull, Edna, B. S., 1909; Instructor in Domestic Science, Bozeman Public Schools, Bozeman, Montana.

Bull, Frieda, B. S., 1907; M. S., 1909; Instructor in Mathematics and Physics, Montana Agricultural College.

Burke, Edmund, B. S., 1907; Chemist and Meteorologist of the Montana Agricultural Experiment Station, Bozeman, Mont.

Butter, Donald, B. S., 1909; Electrical Engineer, Bearmouth, Mont.

Caldwell, Thomas O., B. A. C., 1899; one of four leasers of the Gold Reef Mine, Gilt Edge, Montana.

Chaffee, C. Sarah, B. S., 1906; Instructor in Mathematics and History, Rathdrum High School, Rathdrum, Idaho.

Cockrill, Irvin, B. A. C., 1900; Osteopath Physician, Kirksville, Mo.

Collins, W. E., B. S., 1902; Trust Officer of State Savings Bank, Butte, Montana.

Cooke, Amy, B. S., 1908; Science Teacher in Custer County High School, Miles City, Montana.

Cowan, Lewis, B. C. E., 1904; Irrigation Engineer, Bozeman, Mont.

DeMuth, Maud S., B. S., 1907; Mrs. W. D. Tallman, Bozeman, Mont.

Driscoll, William J., B. S., 1908; Civil Engineer in the employ of the Burlington R. R., Omaha, Neb.

Edwards, Timothy, B. S., 1909; Draftsman N. P. Survey, Oro Fino, Idaho.

Fisher, Charles M., B. S., 1908; Electrical Engineer, Spokane, Wash.

Flager, Harold J., B. E. E,. 1907; Assistant Engineer, Billings and Red Lodge Inter-Urban R. R., Red Lodge, Mont.

Flager, Howard A., B. E. E., 1906; Real Estate Business, Red Lodge, Mont.

Flaherty, Charles David, B. C. E., 1904; Civil Engineer, firm of Sacket & Flaherty, Livingston, Montana.

Foster, Florence, B. S., 1896; Mrs. Burton Flemming, Iowa City, Iowa.

Freeman, Beatrice, B. S., 1900; Mrs. Thomas S. Davis, Columbus, Mont.

Freeman, W. B., B. C. E., 1903; District Engineer U. S. Geological Survey in charge Denver District of Water Resources Branch, Denver, Colorado.

Gardiner, Henry C., B. S. A., 1903; Veterinarian and Proprietor of the Gallatin Veterinary Hospital, Bozeman, Mont.

Gottschalck, Carl, B. S., 1909; Graduate Student Montana Agricultural College.

Griffith, Warren J., B. E. E., 1907; Operator Washington Water Power Co., Spokane, Washington.

Ham, Frank W., B. S., 1903; M. S., 1905; Assistant Professor of Physics, Montana Agricultural College.

Hartman, Lois Kathryn, B. S., 1907; Instructor in Domestic Science Training School of University of Utah, Salt Lake City, Utah.

Hartman, Will, B. S., 1908; City Engineer, Bozeman, Mont.

Hawkins, P. H., M. S., 1903; Banker, Absaroka, Mont.

Henderson, Lyle C., B. S., 1909; Assistant Engineer Missouri River Power Co., Canyon Ferry, Mont.

Hinds, Bert S., B. S., 1909; Assistant Engineer Madison River Power Co., Norris, Mont.

Hutton, Fred, B. E. E., 1902; deceased.

James, John S., B. S., 1909; Civil Engineer, Cascade, Mont.

Jones, Burle J., B. S., 1904; Manager Orangewood Nursery Co., Phoenix, Arizona.

Jones, Wyatt Wagner, B. S., 1901; M. S., 1902; Investigating Injurious Effects of Smelter Smoke on Vegetation for California Experiment Station, Redding, California.

King, Lowell R., B. S., 1904; Civil Engineer in B. &. B. Department C. M. & P. S., Seattle, Washington.

King, Ruby E., B. S., 1909; Mrs. George Hogan, Bozeman, Mont.

Kinney, Edward D., B. C. E., 1907; in Charge of Locating Work Northern Pacific R. R., Ellensburg, Washington.

Kirscher, W. Guy, B. S., 1909; Farmer, Townsend, Montana.

Kirk, Mary E., B. S., 1906; Instructor in English and History, Proctor Academy, Provo, Utah.

Koch, Elers, B. S., 1901; Forest Supervisor U. S. Forest Service, Missoula, Montana.

Lamme, Maurice A., B. S., 1903; Instructor in Mineralogy, Columbia University, New York City, N. Y.

Lewis, Edna, B. S., 1903; Instructor in Mathematics ,Gallatin County High School, and Member County Board of Examiners, Bozeman, Montana.

Locke, Jerome G., B. C. E., 1908; Irrigation Engineer, Bozeman, Mont.

Lorentz, Floyd S., B. E. E., 1907; Electrical Engineer, Toston, Mont.

Maynard, Edna, B. S., 1900; M. S., 1903; Mrs. G. T. Morris, Burley, Idaho.

Monforton, Zoe., B. S., 1901; Mrs. Dr. H. C. Patterson, Bozeman, Mont.

Moore, Ellie J., B. S., 1901; Insurance Solicitor, Spokane, Wash.

Morgan, O. P., B. S., 1896; Farmer, Logan, Montana.

Morris, Elwood, B. S., 1909; Assistant in Botany, Montana Experiment Station.

Morris, Garfield T., B. C. E., 1903; Assistant Engineer Oregon Short Line R. R., Burley, Idaho.

Mountjoy, Agnes, B. S., 1907; Instructor in Physics and Latin, Madison Female Institute, Richmond, Ky.

Noble, Erma, B. S., 1909; Graduate Student, Montana Agricultural College.

Osborne, Belle, B. S., 1907; Mrs. D. E. Fish, Dillon, Mont.

Pease, Jay L., B. C. E., 1907; Montana Representative of the Portland and Seattle Construction Co., Bozeman, Mont.

Penwell, Clyde C.. B, S., 1906; B. E. E., 1907; Student Apprentice Westinghouse Electric Co., Pittsburg, Penn.

Penwell, Clyde W., B. E. E., 1909; Electrical Engineer, Larned, Kansas.

Peters, Orville S., B. S., 1909; Assistant in Electrical Engineering and Graduate Student Montana Agricultural College.

Peterson ,James A., B. S., 1909; Law Student University of Minnesota, Minneapolis, Minn.

Potter, Ermine L., B. S., 1903; Instructor in Animal Husbandry, Oregon Agricultural College, Corvallis, Oregon.

Quaw, Lucile, B. S., 1903; Instructor in Broadwater County High School. Townsend, Montana.

Quaw, Mignon, B. S., 1902; Instructor in Latin and English, Gallatin County High School, Bozeman, Montana.

Quaw, Thos. B., B. S., 1907; Clerk in Grocery Store, Bozeman, Mont.

Reese, Herbert J., B. S., 1904; Chemist, Long Beach, California.

Robinson, J. W., B. S., 1908; Instructor in Chemistry, Montana Agricultural College.

Sacket, Chas. T., B. C. E., 1904; C. E., 1907; City Engineer, County Surveyor of Park County, U. S. Mineral Surveyor, Livingston, Montana.

Sales, Reno H., B. S., 1898; Geologist, Amalgamated Copper Co., Butte, Montana.

Schabarker, W. W., B. M. E., 1902; Night Foreman, Shops, Milwaukee R. R., Milwaukee, Wis.

Schmidt, F. W., B. S., 1903; Superintendent of a Cyanide and Amalgamation Plant, Brazil, South America.

Shaw, W. T., B. S., 1896.

Sloan, W. F., B. E. E., 1903; Electrical Inspector for Railroad Commission, and W. S. B. A. of Wisconsin, Madison, Wis.

Sloan, J. H., B. C. E., 1903; Civil Engineer, Bozeman, Montana.

Spain, W. Whitfield, B. S., 1909; Assistant Supt. of Dry Land Farms, Montana Experiment Station, Bozeman, Mont.

Spragg, Frank A., B. S. A., 1902; Plant Breeder of Farm Crops for the Michigan Experiment Station, Lansing, Mich.

Stafford, Lucy, B. S., 1896; Mrs. William Otis Peck, Pony, Mont.

Tavenner, Frank C., B. C. E., 1903; Instructor in Machine Shops and Mechanical Drawing, California Polytechnic School, San Luis Obispo, California.

Thompson, Homer C., B. S., 1902; Superintendent of Public Schools of Choteau, Teton County, Choteau, and Three Forks, Mont.

Thorpe, Mabel A., B. S., 1907; Secretary in Central Y. W. C. A., Toledo, Ohio.

Thorpe, Elizabeth, B. S., 1907; Teacher in Hungerford Academy, Springville, Utah.

Tracy, Edna B., B. S., 1908; Instructor in Virginia City High School, Virginia City, Montana.

Vreeland, Edna, B. S., 1909; Bozeman, Montana.

Widener, Carl, B. S., 1908; Irrigation Engineer, Victor, Mont.

Williams, Frank B., B. M. E., 1899; Boulder, Montana.

Williams, Lee., B. E. E., 1902; County Surveyor, Powell County and City Engineer, Deer Lodge, Montana.

Wilson, Elva A., B. S., 1909; Student Montana State Normal College, Dillon, Mont.

SCHOOL OF MUSIC GRADUATES.

Alward, Coda, Piano, 1908, Teacher and Student.....Bozeman

Brown, Edith, Piano, 1906, Teacher Regina, Sask., Canada

Featherstone, Ellis, Piano, 1907, Student.....Syracuse, N. Y.

Freeman, Lorraine, Piano, 1906, Student.....Germany

Griffin, Grace, Piano, 1907, Mrs. W. C. Blyth.....Whittier, California

Hartman, Flora, Piano, 1907, Student Syracuse, N. Y.

Lovelace, Amy, Vocal, 1908, Teacher..... Bozeman

Piedalue, Alice, Piano, 1908, Mrs. C. W. Hancock.....Bozeman

Stanton, Grace, Piano, 1901, Mrs. W. B. Walker Glendive

Waters, Mary, Piano, 1902, Mrs. H. L. Houston, Teacher.....Bozeman

Widener, Carl, Vocal, 1908, Civil Engineer..... Hamilton

Widener, Ethel, Piano, 1907, Teacher Spokane, Wash.

DEGREES GRANTED JUNE, 1909.

MASTER OF SCIENCE.

Bull, Frieda M. Mathematics

BACHELOR OF SCIENCE.

Brewer, Lucile Home Science
Bull, Edna Home Science
Butter, Donald Electrical Engineering
Edwards, Timothy F., ... Civil Engineering
Gottschalck, Carl Chemistry
Henderson, C. Lisle Electrical Engineering
Hind, Bert S., ... Electrical Engineering
James, John S., ... Civil Engineering
King, Ruby E., ... Home Science
Kirscher, William Guy Electrical Engineering
Morris, Elwood Agriculture
Noble, Erma, ... Mathematics-Physics
Peters, Orville S., ... Electrical Engineering
Peterson, James A., ... History-Literature
Spain, W. Whitfield Agriculture
Vreeland, Edna Home Science
Wilson, Elva History-Literature

PHARMACEUTICAL CHEMIST.

Mitchell, Paul Pharmacy

NAMES OF STUDENTS.

1909-10.

POST GRADUATES.

Gottschalck, Carl, B. S., ... Chemistry Bozeman
Morris, Elwood, B. S. German Virginia City
Noble, Erma, B. S. Mathematics Bozeman
Peters, Orville S., B. S. Electrical Engineering .. Clinton, Wis.

SENIORS.

Barnard, Robert B. Electrical Engineering Great Falls
Bell, James C. Agriculture Gilt Edge
Booker, Clinton T. Electrical Engineering Helena
Brown, Archie S. Electrical Engineering Great Falls
Carmichael, Effie Home Science Bozeman
Davidson, Mary E. Home Science Bozeman
DeMuth, David R. Civil Engineering Peru, Indiana
Fisher, Helen Home Science Bozeman

Flager, Ruth	Home Science	Red Lodge
Fox, Hazel	Mathematic-Physics	Bozeman
Froebe, Frank J	Civil Engineering	Absarokee
Gray, Wright	Agriculture	Bozeman
Hartman, June	Mathematics-Physics	Bozeman
Henderson, Charles F	Electrical Engineering	Hall
Homann, Fred C	Mechanical Engineering	Bozeman
Kennedy, Cyril C	Electrical Engineering	Glendive
Kimpton ,Addie	Home Science	Radersburg
Kremer, William J	Civil Engineering	Mt. Carroll, Ill.
King, Willard V	Biology	Bozeman
Jacob ,Lillian C	History-Literature	Columbus
Livingston, Walter T	Civil Engineering	Bozeman
Livingston, Mildred B	Home Science	Bozeman
Pool, Louis K	Civil Engineering	Townsend
Quaw, Eugene C	History-Literature	Bozeman
Sloan, William Glenn	Civil Engineering	Helena
Smith, Walter A	Agriculture	Fridley
Walchli, Fred E	Mechanical Engineering	Kalispell
Wylie, Mary	Home Science	Bozeman

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JUNIORS.

Anderson, Lee B	Electrical Engineering	Bozeman
Annin, James T	Agriculture	Columbus
Bancroft, Ray E	Agriculture	Bozeman
Breneman, Helen	Home Science	Bozeman
Buell, Vera O	History-Literature	Bozeman
Cameron, Gertrude	Mathematics-Physics	Bozeman
Carr, Irene H	Home Science	Bozeman
Clark, Ben A	Civil Engineering	Hunters Hot Sp'gs
Clark, Grace	Home Science	Belgrade
Cooley, Ralph	Agriculture	Lo Lo
Dahling, J. Hugo	Civil Engineering	Bozeman
Edsall, William S	Electrical Engineering	Bozeman
Ellis, Edward M	Electrical Engineering	Bozeman
Fiske, Gretchen	Home Science	Helena
Haines, William T	Electrical Engineering	Sheridan
Hamilton, Everett A	Electrical Engineering	Belgrade
Hansen, Gilbert E	Agriculture	Bozeman
Higgins, Lucile	Mathematics-Physics	Bozeman
Hinman, Ruth	History-Literature	Bozeman
Kirk, Grace	Home Science	Salesville
LeFevre, William T	Biology	Kalispell
Metheny, Blanche	Home Science	Bozeman
Morris, Ernest R	Civil Engineering	Virginia City
Peck, Harry	Electrical Engineering	Garneill
Philpott, June	Mathematics-Physics	Bozeman
Piedalue, Irene	Home Science	Bozeman
Sheriff, Court	Agriculture	Helena
Snider, Leta	Mathematics-Physics	Bozeman
Soper, Charles H	Agriculture	Bozeman
Spain, J. Marvin	Agriculture	Bozeman
Thorpe, Harriet	Home Science	Bozeman
Tremper, William G	Civil Enineering	Helena

Wilcox, Guy M.	History-Literature	Dupuyer
Williams, Elmer J.	Electrical Engineering	Great Falls
Williams, Roy B.	Civil Engineering	Bozeman
Williams, Sidney A.	Electrical Engineering	Boulder
Wilson, Harmon	Civil Engineering	Bozeman
Wolpert, Harold E.	Electrical Engineering	Boulder

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SOPHOMORES.

Alexander, Grace	Home Science	Bozeman
Baker, Florence	History-Literature	Bozeman
Bancroft, Ross L.	Agriculture	Bozeman
Chisholm, Alice	Home Science	Bozeman
Cook, George H.	Agriculture	Como
*Couper, Albert C.	Chemistry	Northfield, Minn.
Chapman, William E.	Civil Engineering	Dillon
Daley, Freeman A.	Civil Engineering	Chouteau
Donaldson, Noble C.	Agriculture	Helena
Draper, Charles H.	History-Literature	Red Lodge
Dusenberry, Inez	History-Literature	Bozeman
Dusenberry, Vincent F.	Biology	Bozeman
Edwards, Margaret	Home Science	Great Falls
Franzman, Gladys	Home Science	Phillipsburg
Frischke, Frieda	Home Science	Columbus
Gatton, Florence	Home Science	Bozeman
Green, Jesse R.	Mechanical Engineering	Manhattan
Hagerman, Edna	Home Science	Great Falls
Hansen, Charles L.	Agriculture	Dillon
Hodgskiss, J. Edward	Agriculture	Chouteau
Jones, Kyle	History-Literature	Chouteau
Kirk, Cassius L.	Civil Engineering	Salesville
Lannin, Earl A.	Electrical Engineering	Butte
Lewis, Clara	Biology	Clara
Lewis, Max	Civil Engineering	Dewey
McCraw, John L.	Civil Engineering	Springfield, Mo.
Millegan, Guy J.	Agriculture	Millegan
Morgan, George W.	Agriculture	Bozeman
Morgan, Joe D.	Biology	Bozeman
Piedalue, Laura	Home Science	Bozeman
Pound, Samuel H.	Civil Engineering	Big Timber
Shellenberger ,Marguerite	Home Science	Bozeman
Shovell, William L.	Agriculture	Hamilton
Smith, Maud	Home Science	Belgrade
Stanley, Howard	Electrical Engineering	Great Falls
Taylor, John E.	Agriculture	Chinook
Willson, Walter	Electrical Engineering	Bozeman

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FRESHMEN.

Alderson, Myrtle	History-Literaturee	Helena
Anderson, Vera	Home Science	Bozeman
Blinn, George W.	Agriculture	Butte
Bancroft, Clark	History-Literature	Bozeman
Barnett, Rita	Home Science	Dillon

*Deceased.

Bole, Margaret	Mathematics-Physics	Bozeman
Brabrook, Ralph S	Civil Engineering	Atlanta, Ga.
Brook, Thomas B	Mechanical Engineering	Bozeman
Buckley, Thomas W	Electrical Engineering	Manhattan
Blessing, John	Agriculture	Brownsville, Minn.
Cameron, Christine	Home Science	Bozeman
Chambers, Edwin A	Chemistry	Cascade
Clark, Olive	Home Science	Bozeman
Dahling, Louis F	Civil Engineering	Bozeman
Dawes, Rhoda	Home Science	Bozeman
deLacy, Walter	Agriculture	Helena
Douglass, Stanley	Electrical Engineering	Bozeman
Elske, Michael	Electrical Eng	Carrington, N. D
Esmay, Julien	Agriculture	Thermopolis, Wyo.
Fisher, Wallace	Electrical Engineering	Bozeman
Fox, Walter M	Electrical Engineering	Bozeman
Franks, Ethel M	Home Science	Bozeman
Fraser, Charles L	Civil Engineering	Columbus
Gatton, Dorothy	Home Science	Bozeman
Gordon, Fred E.	Agriculture	Sanders
Griffith, Gilbert	Civil Engineering	Bozeman
Hartman, Brooke	Civil Engineering	Bozeman
Hartman, Ruth	Home Science	Bozeman
Hill, Lewis	Mechanical Engineering	Livingston
Hollier, Georgia	History-Literature	Bozeman
Huffman, Mae	Home Science	Phillipsburg
Hutton, Lontie H	Electrical Engineering	Jeffers
Jackson, Ernest W	Agriculture	Harrison
Kirk, Howard S	Civil Engineering	Bozeman
Knox, Howard	Electrical Engineering	Butte
Kruse ,Jacob	Agriculture	Bozeman
Leinard, Ford B	Agriculture	Bryan, O.
Lockhart, Harold	Agriculture	Helena
McDonald, Christopher A	Agriculture	Butte
Martin, Claude A	Civil Engineering	Stockett
McGuire, J. Frank	Agriculture	Shannon
McLean, Annis C	Electrical Engineering	Bozeman
Moore, James	Mechanical Engineering	Hamilton
Nelson, Frank M	Agriculture	Livingston
Powell, Hollis	Electrical Engineering	Livingston
Roades, Eva	Home Science	Bozeman
Rubottom, Carter V	Agriculture	Great Falls
Sacket, Nathalie	Civil Engineering	Bozeman
Seamans, Arthur E	Agriculture	Wauwatosa, Wis.
Schumacher, Hettie	History-Literature	Bozeman
Sleeman, Elmer	Agriculture	Stevensville
Smith, Mary A	Home Science	Dillon
Smith, Ray E.	Chemistry	Livingston
Sloan, Mary	Home Science	Bozeman
Soper, Joseph R	Agriculture	Bozeman
Spain, Roy	Agriculture	Bozeman
Spaulding, George W.	Mechanical Engineering	Salesville
Talmage, Earl C	Electrical Engineering	Red Lodge
Truman, Joseph K	Electrical Engineering	Bozeman
Wharton, John C	Agriculture	Butte

Walker, L. Arthur Mechanical Engineering ..Fort Benton
Willey, Leroy D.....Agriculture Dillon
Wight ,Frank A.....Agriculture .. White Sulphur Springs
Winter, William History-Literature Bozeman
Wylie, Lawrence Electrical Engineering Bozeman
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IRREGULAR.

Armstrong, Edith History-Literature Bozeman
Bennett, Frances Art Livingston
Bromley, Merle Art Bozeman
Cline, Eva Art Bozeman
Cooper, Mariam Home Science Bozeman
Crocker, Emmett R.....Civil Engineering Grand Junction
Mitchell, Agnes Home Science Bozeman
Powers, Ruth H.....Home Science Bozeman
Smith, Helen A.....History-Literature DuQuoin, Ill.
White, John J. Civil Engineering Fargo, N. D.
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SCHOOL OF PHARMACY.

SECOND YEAR.

Allen, Edgar W. Joliet
Conard, Blanche Bozeman
Cox, Harvey Bozeman
Drinville, James Kendall
Valentine, Charles P.....Helena
Wilson, Nicholas W.....Bozeman
Young ,Earl Belt
7

FIRST YEAR.

Brown, Everett Bozeman
Crosby, Spencer J., White Sul. Spgs.
Love, Raymond V. Bozeman
Morris, Florence A....Virginia City
Simpson, John H.....Columbus
Temple, Leslie C.....Radersburg
Williams, Elmer H.....Radersburg
7

PREPARATORY SCHOOL.

FOURTH YEAR.

Anderson, Ruth Bozeman
Buford, Luther Virginia C..y
Cline, Victor Bozeman
Davis, Will Bozeman
Hauswirth, Herbert Anaconda
Kennedy, Everett Harlem
Lewis, Albert Clara
Lewis, Arline Dewey
McKnight, Virgil A.....Red Rock
McMahon ,Blanche Big Elk
Shiell, Helen Straw
Van Camp, Ethel Two Dot
Wetzel, Wylie Pony
Winter, Nelia Bozeman
14

THIRD YEAR.

Allard, Peter Laurel
Bancroft, Alma Bozeman
Breneman, Edith Bozeman
Bradley, Valeria Bozeman
Distad, John Bozeman
Hardgrove, Everett Stearns
Kammerer, Harry Bozeman
Kirby, Noah Gebo
*Labrie, Tilford Harlowton
Mackay, Charles Helena
Moore, Inez Bozeman
Pope, Harold Big Timber
Roberson, Bess Sixteen
Smith, Ralph Belgrade
Simpson, Kate Bozeman
Shriver, Frank Jeffers
Vreeland, Marjory Bozeman
Walker ,Maryette Fort Benton
Wilkins, Roy Laurel

*Deceased.

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SECOND YEAR.

Alexander, Edward Cardwell
Bower, Edith Jeffers
Brook, Gladys Bozeman
Crouse, Lester Belgrade
Distad, Amanda Bozeman
Higgins, Patti Bozeman
Jamison, Peter Fort Shaw
Lorentz, Noyes Toston
McKee, Zora Jeffers
Reynolds, Nettie Twin Bridges
Sexton, Earl Belgrade
Takenaka, George Moji, Japan
Tucker, Walter Flesher
Urbach, Albert Livingston

14

FIRST YEAR.

Allison, William F.....Cut Bank
Cook, Charles W.....Roundup
Cook ,William C.....Willow Creek
Carter, Howard Livingston
Donovan, David Great Falls
Dwyer, Harold Butte
Dwyer, Gerald Butte
Esp, Albert Big Timber
Esp, Tilmar Big Timber
Flint, Nelson Bozeman
Gareau, Chester, Hunters Hot Spgs
Henderson C,arl Chicago, Ill.
Kishi, Ahkira Japan
Lindstrand, Florence Elso
Milam, Stanley Augusta
Monson, William Ovando
Milner, Elmer Troy
Sheridan, Mary Big Timber
White, Sylvester J.....Augusta
Weldy, Marguerite.... Chester

20

SCHOOL OF AGRICULTURE.

THIRD YEAR.

Jackson, Joel C.....Harrison
Taylor, Fred B Bozeman

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SECOND YEAR.

Bailey, Joseph Spencer, Iowa
Calk, Thomas Mt. Sterling, Ky.
Crouch, Leslie B.....Great Falls
King, John A.....Fort Benton
Moger, Fred C.....Bozeman
Peck, John Garneill
Work, Lester Bozeman

7

FIRST YEAR.

Alt, Joseph Stearns
Bevans, John T.....Helena
Bradshaw, J. Riley Helena
Brennan, James J.....Harrison
Buckley, Charles R. Manhattan
Calkins, Percy Cody, Wyo.
Campbell, Archie W.....Sixteen
Clement, Robert F. Flatwillow
Degenhart, Chris Phillipsburg
Duffield, William A.....Joliet
Elliott, Francis A.....Malta
Fitzpatrick, Mark L.....Avon
Fitzpatrick, Patrick Avon
Gordon, M. B.....Belgrade
Hogan, Ralph M.....Musselshell
Hope, Charles M.....Cut Bank
Jeffers, Lawrence M. Jeffers
Holland, Eli Joliet
Keith, Dodds Chester
Kieckbusch, Carl Townsend
Kieckbusch, Geeorge Townsend
Koerber, Joseph F.....Bozeman
Kyle, Charles L.....Cardwell
Kyle, Fred Cardwell
Lockhart, Percy G.....Helena
McCarrick, James.....Norfolk, Va.
McGuire, George Shannon
Metier, Earl C.....Belgrade
Murray, William Hamilton
Norman, Frank A.....Belgrade
Norton, Charles W.....Bozeman
Northway, Glenn E.....Forsyth
Schurch, Walter E.....Deer Lodge
Seidensticker, John C..Twin Bridges
Sailor, Howard Guilford
Seyler, Edwin E.....Twin Bridges
Steinback, Henry A.....Stearns
Timmons, John M.....Harve
Underseth, Theodore Birdseye
Wallace, Boyd B....Tuscarora ,N.Y.
Woodward, Leslie E. Divide

41

ONE YEAR COURSE IN HOME SCIENCE.

Arnold, Josephine Bozeman
Boomer, May Bozeman
Beerstecher, Dorothea Belgrade
Callahan, Agnes Bozeman
Celander, Celma Joliet
Celander, Nellie Joliet
Corrie, Eva Bozeman
Davidson, Pearl Bozeman
Dunckel, Irene Butte
Edwards, Elma Windham
Feazell, Grace Bozeman
Fowler, Alice Bozeman
Fowler, Bertie Bozeman
Franks, Isa Whitehall
Gerlinger, Mina Glendive
Highworden, Florence Darby
Jones, Edith Bozeman
Kopp, Hattie Seaside, Oregon
Matthews, Ella Cardwell
McElwee, Cecelia Bozeman
Milner, Lucile Idaho Falls, Idaho
Nelson, Clementine Bozeman
Norton, Fannie Bozeman
Rea, Helen Bozeman
Sears, Edith Bozeman
Uhl, Anna Livingston
Walker, Montana Bozeman
Williams, Cressy Bozeman

28

WINTER COURSES IN AGRICULTURE.

Anceny, Charles Salesville
Anderson, Albert H.....Bozeman
Boddy, George F.....Bozeman
Bohart, W. O.....Bozeman
Bradley, E. A.....Bozeman
Bristow, W. H.....Belgrade
Brittan, L. A..... Bozeman
Carlson, John A..... ..Farmington
Crawford, O. T..... Belgrade
DeVore, J. N..... Bozeman
English, J. D..... Stockett
English, J. L..... Stockett
Eberhart, John Bozeman
Finch, George P.....Garneill
Fox, H. F..... Sedan
Foust, J. M..... Bozeman
Freeman, J. H.....Pray
Gallop, R. G.....Livingston
Gibbs, W. D.....Bozeman
Good, H. C.....Belgrade
Gordon, Bryant Belgrade
Gustin, Dewey C. Twin Bridges
Haley, J. P. Sedan
Harrer, Henry Belgrade
Holgate, J. D..... Bozeman
Holgate, Thomas Bozeman
Humphrey, Thomas Sedan
Kelly, E. J.....Fort Benton
Kirk, Harris Salesville
LeMunyon, Riley Manhattan
Lindsey, Theodore Kendall
Lovely, Justin D.....Clyde Park
Maynard, E. A.....Jeffers
McFadden, George Bozeman
McMann, John Butte
Noble, Joseph L.....Huntley
Rightenour, E. Sheridan
Sambells, Thomas Butte
Sanborn, Henry L.....Absarokee
Sandquist, Charles Belgrade
Skalitzky, B. L.....Bozeman
Smith, Kirk Livingston
Spohr, James Boulder
Spohr, Mrs. James Boulder
Thomas, Thomas Ovando

45

SCHOOL OF MUSIC.

Accola, Estelle Piano Bozeman
Accola, Grace Piano Bozeman
Anderson, Vera Vocal Bozeman
Baker, Florence Vocal Bozeman
Baker, Lulu Vocal Bozeman
Bancroft, Alma Piano Bozeman
Bancroft, Ross Vocal Bozeman
Barnett, Rita Piano Dillon
Benge, Faith Piano and History..Winterset, Iowa
Breneman, Helen Piano Bozeman

Bromley, Mary	Piano	Bozeman
Buell, Vera	Vocal, Piano	Bozeman
Cameron, Christine	Piano	Bozeman
Carr, Irene	Piano	Bozeman
Catron, Pearl	Piano	Bozeman
Celander, Celma	Piano	Joliet
Clarke, Grace	Vocal	Belgrade
Colbern, Reba	Piano	Bozeman
Comms, Orville	Piano	Gardiner
Cooper, Mariam	Vocal, Piano	Bozeman
Corrie, Eva	Piano	Bozeman
Davidson, Mary	Piano	Bozeman
Dawes, Bessie	Vocal	Bozeman
Dawes, Rhoda	Piano	Bozeman
Dunckel, Irene	Vocal	Butte
Dusenberry, Inez	Vocal	Bozeman
Edwards, Elma	Piano	Windham
Feazell, Grace	Piano	Bozeman
Fisher, Wallace	Vocal	Bozeman
Flager, Ruth	Piano	Red Lodge
Franks, Isa	Piano	Whitehall
Fransham, Edna	Piano	Bozeman
Frischke, Frieda	Piano	Columbus
Gatton, Florence	Piano	Bozeman
Gerringer, Mina	Vocal and Piano	Glendive
Hagerman, Edna	Vocal and Piano	Great Falls
Hamilton, Erlice	Piano	Bozeman
Hamilton, Gail	Piano	Bozeman
Harris, Vera	Piano	Bozeman
Hartman, June	Piano and History	Bozeman
Higgins, Lucile	Piano	Townsend
Highworden, Florence	Vocal and Piano	Darby
Hofner, Georgia	Piano and Harmony	Bozeman
Hufman, Mae	Piano	Phillipsburg
Jacobs, Lillian	Vocal and Piano	Columbus
Kinney, Martha	Violin	Bozeman
Kirk, Grace	Piano	Salesville
Kirschner, Hortense	Piano	Bozeman
Kountz, Josephine	Piano	Bozeman
Lewis, Arline	Piano	Bozeman
Linfield ,Azalea	Piano	Bozeman
Linfield, Leila	Piano	Bozeman
Lindstrand, Florence	Piano	Roundup
Matthews, Ella	Piano	Cardwell
Milner, Lucile	Vocal and Piano	Idaho Falls
Moore, Edna	Vocal	Bozeman
Nicholas, Ernestine	Vocal	Bozeman
Nicholas, Grace	Piano	Bozeman
Noble, Florence	Piano	Bozeman
Patton, Eleanor F.	Harmony and History	Bozeman
Piedalue, Irene	Vocal	Bozeman
Piedalue, Laura	Piano	Bozeman
Philpott, June	Piano	Bozeman
Roecher, Chester	Piano	Bozeman
Roecher, Rausie	Piano	Bozeman

Schumacher, Hettie	Piano and Harmony	Bozeman
Sears, Edith	Piano	Bozeman
Shellenberger, Rita	Piano	Bozeman
Simpson, Kathryn	Piano	Bozeman
Smith, Helen	Vocal	Bozeman
Smith, Erma	Piano and Harmony	Bozeman
Smith, Winifred	Piano	DuQuoin, Ill.
Snider, Leta	Piano	Bozeman
Thompson, Ethel	Piano	Bozeman
Thorpe, Harriet	Piano	Bozeman
Thorpe, Florence	Piano	Bozeman
Tinder, Clara	Piano	Bozeman
Walker, Montana	Piano	Bozeman
Webster, Annis	Piano	Bozeman
White, Earl	Piano	Bozeman
Wilson, Anna	Vocal	Bozeman
Wilson, Kate	Vocal	Bozeman
Wylie, Mary	Piano	Bozeman

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EIGHTEENTH
ANNUAL CATALOGUE

Montana
State College of Agriculture
and Mechanic Arts

1910 - 1911

Bozeman Chronicle Print
Bozeman, Montana



Calendar

1911

Registration and Examinations for Entrance and Conditions.....Monday and Tuesday September 11 and 12
Instruction Begins.....8:00 A. M., Wednesday, September 13
Joint Reception by Christian Association.....Friday, September 29
School of Agriculture Begins.....Tuesday, October 10
Columbus Day, a Holiday.....Thursday, October 12
Standing of Students Reported.....Friday, October 27
Thanksgiving Recess.....Thursday, Friday and Saturday, November 30-December 2
Standing of Students Reported.....Friday, December 15
Christmas Vacation Begins.....12:00 P. M., Wednesday, December 20

1912

Vacation Ends.....8:00 A. M., Wednesday, January 3
Examinations Begins.....9:00 A. M., Monday, January 22
Declamatory Contest.....Thursday, January 25
First Semester Ends.....Friday, January 26
Examinations for Conditions.....Friday and Saturday, May 31 and Junel
Registration for Second Semester.....Tuesday, January 30
Instruction Begins.....8:00 A. M., Wednesday, January 31
Lincoln's Birthday, a Holiday.....Monday, February 12
Washington's Birthday, a Holiday.....Thursday, February 22
Standing of Students Reported.....Friday, March 8
School of Agriculture Ends.....Friday, March 22
Standing of Students Reported.....Friday, April 19
Campus Day.....Saturday, May 4
Arbor Day, a Holiday.....Tuesday, May 14
Examinations Begin.....9:00 A. M., Monday, May 27
Memorial Day, a Holiday.....Thursday, May 30
Examinations for Condition.....Friday and Saturday, May 31 and June 1
Baccalaureate Address.....8:00 P. M., Sunday, June 2
Music Recital.....8:30 P. M., Monday, June 3
Class Day Exercises.....2:00 P. M., Tuesday, June 4
President's Reception.....9:00 P. M., Tuesday, June 4
Commencement.....Wednesday, June 5
Alumni Banquet.....2:00 P. M., Wednesday, June 5

Montana State Board of Education

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(Term expires February 1, 1912)

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Band Instructor.

MRS. MARY K. WINTER
Librarian.
GEORGE R. CALLOWAY
Secretary of the College.

STANDING COMMITTEES.

AGRICULTURE—Atkinson, Cooley, Clark, Whipple, Taylor.
ASSEMBLY—Ham, Duddy, Oliver.
ATHLETICS—Swingle, Kneale, Schermerhorn.
BUILDINGS—Clark, Mollett, Thaler.
COMMENCEMENT—Miss Brewer, Miss Cantwell, Oliver.
ENGINEERING—Thaler, Dearborn, Kneale, Snow, Marshall.
LIBRARY—Hamilton, Cobleigh, Thaler.
PUBLICATIONS—Brewer, Swingle, Kneale.
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Montana Experiment Station

STATION STAFF

F. B. LINFIELD, B. S. A., Director.
R. A. COOLEY, B. S., Entomologist.
ALFRED ATKINSON, B. S. A., Agronomist.
ROBERT W. CLARK, B. S. A., Animal Industry.
EDMUND BURKE, B. S., Chemist.
DEANE B. SWINGLE, M. S., Botanist and Bacteriologist.
O. B. WHIPPLE, B. S., Horticulturist.
W. J. TAYLOR, D. V. M., Veterinarian.
J. B. NELSON, Superintendent Dry Farm Work.
REUBEN M. PICKNEY, B. S., A. M., Assistant Chemist.
L. F. GIESEKER, B. S., Assistant Agronomist.
W. F. SCHOPPE, B. S., Assistant Poultryman.
H. E. MORRIS, B. S., Assistant Botanist.
J. R. PARKER, B. A., Assistant Entomologist.
LYMAN G. SCHERMERHORN, B. S., Assistant Horticulturist.
R. F. MILLER, B. S. A., Assistant in Animal Industry.
HERBERT B. BONEBRIGHT, B. S., Assistant in Agricultural Engineering.

In connection with the college, the Montana Agricultural Experiment Station is conducted. The object of this station is to further the interests of the agricultural industries of the State of Montana. This is done by conducting researches and experiments, which may include the physiology of plants and animals; the diseases to which they are severally subject, with remedies for the same; the chemical composition of useful plants at their various stages of growth; the various subjects connected with irrigation; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soil and water; the chemical composition of manures, natural and artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly upon the agricultural industry of Montana as may seem advisable.

The experiment station farm, consisting of 380 acres, adjoins the college grounds. It is provided with the necessary barns, granaries, tool houses, farm implements, live stock, gardens, greenhouses and orchards.

Sub-stations for experimental work in dry farming are maintained in various parts of the state and are conducted in co-operation with the railroads and the United States Department of Agriculture. A substation for experiments in horticulture has been established in the western part of the state.

The Montana Experiment Station is supported by the annual appropriations from the Federal government under the Hatch and Adams Acts, supplemented by growing appropriations from the state.

The station issues during the year a series of bulletins, which put in practical form the results of the experimental work. These are sent, upon request, to any citizen of Montana who will apply for them, and any such may have his name entered upon a mailing list and receive all bulletins as soon as issued.

Address, Director, Experiment Station, Bozeman, Montana.

State College of Agriculture and Mechanic Arts

The purpose of the colleges of agriculture and mechanic arts is chiefly to provide industrial education in agriculture, engineering, household economy, and applied science, for the young men and women of the respective states in which they are located. The scope of the Montana Agricultural College is set forth in the two so-called Morrill Acts of Congress, which authorized this class of institutions and supplied in part endowment and funds for maintenance; and in an act of the Montana

Legislature accepting the land and money grants from the national government.

The first Morrill Act of Congress of July 2, 1862, making a land grant for the partial endowment of the agricultural and mechanical colleges states that the income from these lands shall be used to maintain colleges "where the leading object shall be, without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

The second Morrill Act of Congress, August 30, 1890, making an annual appropriation out of the treasury of the United States for the further support and endowment of these colleges, provides that this fund is "to be applied only to instruction in agriculture and mechanic arts, the English language, and the various branches of mathematical, physical, natural and economic sciences with special reference to their application to the industries of life; and to the facilities for such instruction."

The Act of the Montana Legislature, approved February 16, 1893, accepts these grants of lands and money and states that the Montana Agricultural College shall have for its object "instruction and education in the English language, literature, and mathematics, civil and mechanical engineering, agricultural chemistry, animal and vegetable anatomy and physiology, the vetinary art, entomology, geology, and such other natural sciences as may be prescribed by the State Board of Education; political, rural and hosehold economy, agriculture, horticulture, history, book-keeping and especially the application of science and the mechanical arts to practical agriculture in the field, and irrigation and the use of water for agricultural purposes."

ENDOWMENT.

The Enabling Act, providing for the admission of Montana into the Union, approved February 22, 1889, Sec. 16, grants 90,000 acres of land to Montana for the use and support of an agricultural college according to the terms of the Act of Congress, July 2, 1862, and Sec. 17, grants an additional 50,000 for the same purposes, and subject to the same conditions and limitations as the other grant. The 140,000 acres of land cannot be sold for a price less than $10.00 per acre, and the principal, together with all money received from the sale of timber, is to be invested as a permanent endowment. The unsold lands may be leased and the rentals together with the interest on the permanent endowment shall be used for the maintenance of the college.

The Act of Congress of August 30, 1890, appropriates $25,000 annually out of the treasury of the United States. By the Nelson bill, passed March 3, 1907, this amount was increased annually by $5,000 each year, begining in 1907, until now the total annual appropriation has reached $50,000, at which figure it is to remain.

LOCATION.

Bozeman, the county seat of Gallatin county, is on the main line of the Northern Pacific railroad, and on a branch of the Chicago, Milwaukee and Puget Sound railroad. For convenience, healthfulness and beauty of surroundings, the location is unsurpassed. The college is situated on an elevation which commands a view of one of the most fertile valleys in the world, covered far and wide with grain fields, and hemmed in on all sides by lofty mountains.

Bozeman is a city of homes and churches, with a wholesome moral environment. It is a most desirable residence city for families who wish to educate their children. Expenses are moderate and there are all the conveniences of a modern city. The college is reached from the railroad station and city by the electric car line.

CAMPUS AND FARM.

The grounds and farm contain three hundred and eighty acres. Forty acres in the immediate vicinity of the building constitute the campus and recreation grounds, which are in lawn, interspersed with flower beds, shrubbery, trees and driveways. The remainder is used for farming and experimental purposes.

BUILDINGS.

College Hall, situated in the center of the college campus is a substantial structure of brick and stone, having a total length of one hundred and twenty-eight feet and a width of ninety feet. It is three stories high and has a basement, which furnishes quarters for mechanical drawing and three class rooms. On the first floor are offices for the president and secretary, one room each for the Young Men's and the Young Women's Christian Associations, three large class rooms and the reading room and library. The north half of the second floor is devoted to the art department, the arrangement being such that three large rooms can be thrown together, by sliding doors. The south half of the second floor is used by the department of the civil engineering, and has one office, one seminar room, two recitation rooms and a drawing room. The third floor contains the large assembly hall and seven class and music rooms.

Hamilton Hall.—This is the new dormitory for women, built in 1910. It was named by the faculty for the late Mrs. James M. Hamilton. It is one hundred twenty by fifty eight feet, three stories and basement. It is constructed of brick with hard wood floors and Oregon fir finish. It is equipped with steam heat, electric lights and baths. The rooms are single and in suites, and all rooms have both hot and cold water. In the basement are the store rooms, laundry, quarters for servants, kitchen and large dining room. The first floor contains the reception rooms, the Dean's suite, guest room and a number of rooms for students. The second and third floors are for students.

Agricultural Hall is a three story building, one hundred and fifty

feet by sixty-eight feet, pressed brick, tile roof, maple floors and modern equipment throughout. The north half of the first floor contains the quarters for dairying, consisting of storerooms, office, class room, butter and cheese rooms and laboratories. The south half of this floor is used for horticulture and has seed room, office, class room, work room, and laboratory. The north half of the second floor is occupied by the agronomy department with office, class room, dry land office and soil and grain laboratories. In the south half are offices for the director of the experiment station, superintendent of farmers' institutes, class room, office and laboratory for the department of animal industry. The third floor is devoted to home science, and contains two large kitchen laboratories, two dining rooms, two class rooms, three sewing rooms, offices and one room for training in nursing.

The Chemistry and Physics Building is located west of College Hall. It is sixty by one hundred feet, of pressed brick, and is three stories high including the basement. The basement is occupied by the physics lecture room, pharmacy lecture room and laboratory, the mineralogical and assay laboratory, and the museum of geology and mineralogy. The main floor is occupied by the office and department library a lecture room, a preparation room, and the experiment station laboratory. The east half of the second story contains the laboratories for physics and the west half the qualitative and the quantitative laboratories.

The Biology Building, consisting of three stories and basement, is brick veneered. On the top floor is a lecture room and a museum containing the zoological collections. On the floor below are three laboratories for bacteriology, botany and zoology, and an office and work room for the botanist. The west half of the first floor is a large laboratory for general biology and the east half is occupied by the office, library and work room for the entomologist. The basement contains work rooms, class room, store rooms, herbarium room and dark room. Attached to this building on the south is a greenhouse, 50 by 36 feet, for botanical purposes, and an insectary, 18 by 10 feet, for the study of living insects.

Engineering Hall. The Legislative Assembly made in March, 1911, an appropriation of $60,000 for an Engineering Hall. It is expected that this building will be ready for occupancy in September, 1912, and will be used chiefly for civil and electrical engineering. The college already owns a large and well selected equipment for these departments. This new building will afford ample space to install this equipment and give opportunity for considerable enlargement in engineering facilities and instruction.

The Engineering Laboratory is a two story stone building, 55 by 33 feet, with a frame annex 36 by 20 feet. The first floor contains the dynamos, motors, two steam engines and strength of material testing machines. The second story is occupied by the storage battery, photometer and electric light rooms, class room and the office of the professor of electrical engineering. The first floor of the annex contains the cement laboratories, and the second floor is used for electrical designing.

The Shops are in a one story frame building. The main part is 60 by

100 feet and contains a forge shop 27 by 60 feet, a machine shop 44 by 72, an office, a wash room, and a tool room. It has one wing 36 by 50 feet for woodwork and another 36 by 48 feet for foundry.

The Power House is a brick building 76 by 32 feet. It contains a one hundred and twenty-five horse-power Stirling water-tube boiler, and a one hundred and twenty-five horse-power Root water-tube boiler. An eighty-five horse-power engine is directly connected with a forty K. W. dynamo to furnish power for electric lights, the ventilating fans and the shops. There is also a sixteen horse-power vertical type of engine and a ten horse-power engine which drives the fan for the power house stack.

The Gymnasium is a frame building 100 by 60 feet, with two rooms each 14 by 12 feet on the south end, fitted with shower and needle baths. This building is heated and lighted and has a good floor for gymnasium work. In the south end are two dressing rooms each 28 by 12 feet, with lockers. Along each side and at the ends are permanent seats, amphitheatre style. The hall furnishes a convenient place for gymnasium practice, basket ball and other indoor athletics.

The Cattle Barn is a two story frame building 120 by 86 feet and of fine architectural appearance. On the first floor is the dairy stable, quarters for young stock, a stock judging room, 40 by 40 feet, box stalls, feed bins and offices. The second story is used for storage of hay. All stables have cement floors and iron stalls.

The Veterinary Building is a two story frame structure, 25 by 40 feet, with a one story wing 20 by 40 feet. On the first floor are the office of the veterinarian, two laboratories and an operating room. The second floor contains a laboratory and a class room.

The Horse Barn is a two story frame building 86 by 44 feet. It contains a living room, carriage room, feed bins, fourteen single stalls, three double box stalls, and space for 100 tons of hay.

The Beef Cattle Barn is 50 feet square with two wings each 24 by 28. It is equipped for feeding experiments and has feeding pens, space for hay, grain bins, and weighing room.

The Sheep barn has a main part 40 by 50 feet and two wings, one 20 by 72 feet, the other 20 by 88 feet. In addition to the pens this building is provided with root cellar, wool and shearing rooms, hay loft, feed bins, and room for the attendant.

The Seed Barn and Granary is a two story building and affords ample storage room for the field crops on the station farm.

The Piggery consists of a main building 30 by 35 feet, with two wings, 16 by 50 feet each. In the main building are the feeding rooms and slaughter room, while the wings provide six pens each, for the hogs.

The Poultry Plant consists of two buildings. One is 122 by 15 feet with a center extension 40 by 20 feet. The center contains the feed room, office, laboratory and living room. Underneath is the incubator cellar. One wing is a brooder house and the other has six pens with yards. The other house is 120 feet long and provides eight pens.

The Station Heating Plant is a neat brick structure just west of the biology building, and furnishes the steam for the adjacent buildings.

Greenhouses. An appropriation of $10,000 is now available for new greenhouses. These new greenhouses will be ready for use by September of the present year and will add much to the scope and efficiency of the work in botany, horticulture, agronomy and other kinds of plant studies. The main greenhouse will be placed at the north end of agricultural hall and an addition will be made to the one at the biology building.

ROOM AND BOARD.

All women students whose homes are not in or near Bozeman are expected to live in the Woman's Dormitory. This building is completely furnished throughout with high grade furniture. All modern conveniences, such as hot and cold water in the rooms, baths, steam heat and electric lights are provided. The college manages the dining room and the table board is excellent in quality. The dormitory is under the supervision of the Dean of Women, and the young women have as good care and training as is given at any institution. Everything is provided at actual cost. Board and room is given for $25.00 per calendar month. A small reduction is made when two occupy a single room.

There is no men's dormitory connected with the college but about twenty young men can be accommodated at the club on the campus where rooms and board may be had for $20.00 per month. Students who do not live in the dormitory or at the club find room and board in private families convenient to the college, at from $20.00 to $25.00 per month. The total college expense for the year, including tuition, books, room, board and incidental expenses may be estimated from $250.00 to $350.00. A list of approved places with prices and accommodations is kept in the president's office. A committee of students meets all trains on registration days and at other times on request, and aids in finding satisfactory locations. Students arriving in Bozeman in the day time should take car from the depot to the college.

FEES.*

1—Annual matriculation fee for college, preparatory, pharmacy, art, and one year home science courses	$12.00
2—Annual matriculation fee for school of agriculture	6.00
3—Annual matriculation fee for four weeks' course in dairying	2.00

DEPOSITS.*

Agriculture—Agronomy (2) per semester	$ 2.00
Dairy (1), (2), (a) or (c) per semester	2.00
Horticulture (1) per semester	1.50
Horticulture (4) per semester	5.00

*A fee is a fixed charge and no part is returned. The deposits cover the cost of materials and breakage in the laboratories and any unused balance is returned.

Art—Art (1), (3), (4), (5), (6), (7), (8), (9), (a) or (b) per semester	1.00
Art (2) per semester	2.00
Art (10), (11), (12), (13) or (14) per semester	5.00
Biology—Biology (a) or (b) per semester	1.00
Biology (4), (5), (6), (c) or (d) per semester	1.50
Biology (10) or (12) per semester	6.00
Biology (1), (2), (3), (9), (11) or (13) per semester	3.00
Chemistry—Chem. (1) per year	8.00
Chem. (2), (3), (4), (5), (7), (8), (9) per semester	8.00
Chem. (10), (11) or (12) per semester	6.00
Chem. (13) per semester	20.00
Engineering—C. E. (1), (2), (4), (11), (13), (15), (19) or (20) per semester	1.50
E. E. (4), (6), (10) or (12) per semester	3.50
M. E. (a) per year	3.00
M. E. (b) per year	5.00
M. E. (c), (d), (e), (g), (h), (i), (j), (k), (2), (4), (4a), (9), (17), (21), (27) or (30) per semester	2.00
M. E. (6) per semester	3.00
M. E. (14) or (15a) per semester	1.50
M. E. (20) or (28) per semester	5.00
Home Science—H. S. (1), (6) or (8)	3.00
H. S. (5)	1.00
H. S. (4), (a) or (b)	4.00
H. S. (2) or (e)	5.00
Sewing (12), (13), (14) or (b) per semester	.50
Sewing (11) per semester	4.00
Sewing (16) per semester	.75
Sewing (a) per semester	1.00
Sewing (e) per semester	1.50
Pharmacy—Phar. (1) or (10) per semester	4.00
Phar. (4) or (8) per semester	8.00
Phar. (5), (6) or (11) per semester	2.00
Physics—Physics (a) per year	1.00
Physics (1a) per year	2.00
Physics (2) per year	3.00
Physics (4) or (6) per semester	2.00
Physics (5) per semester	3.00
Veterinary Science (2) per semester	5.00

ADMISSION.

Admission to the freshman class, in any of the college courses, is granted: (a) By a certificate of graduation from an accredited high school. (b) By examination in the subjects required by the college for entrance. (c) By faculty approval of grades from other than accredited high schools. (d) By graduation from the preparatory school.

Candidates for admission to the preparatory school, the one year course in domestic science and the school of agriculture, must have completed the eighth grade in the public schools or its equivalent. One year of high school work is required for admission to the school of pharmacy. There are no set requirements for music and the short agricultural courses, all being admitted who give evidence of being able to profit by the work. All candidates for admission to the institution in any department whatever are required to present the requisite diplomas or certificates for work previously done in other schools and no registration is complete until such credentials are presented and passed upon.

ENTRANCE REQUIREMENTS.

Fifteen units are required for admission to the freshman class in any college course.

Any one with not less than thirteen units may be admitted conditionally, but the units of preparatory work which have not been offered at entrance must be given preference over college subjects.

A unit for admission shall consist of work to the amount of five recitation periods per week of forty-five minutes each or four recitation periods per week of sixty minutes each, for a year of not less than thirty-six weeks.

Two periods of laboratory, shop work, or drawing shall count as one recitation.

In accordance with the present rules of the State Board of Education the following are required of all applicants for admission without condition to the freshman classes:

1—English Composition and Literature, 4 units.
2—Language other than English, 2 units.
3—Mathematics, 2 units.
4—Science, 1 unit.
5—History, 1 unit.

The remaining units will be selected from the following:

1—Language other than English, 4 units.
2—Mathematics, 2 units.
3—Science, 3 units.
4—History, including Civics and Economics, 3 units.
5—Drawing, 2 units
6—Commercial subjects, 4 units.
7—Industrial subjects, including Home Economics, Mechanic Arts and Agriculture, 6 units.

Admission without condition to the courses in engineering and mathematics-physics requires three years of Mathematics and one year of Physics.

REGISTRATION.

Matriculation. Students entering the college for the first time, must present their credentials or pass examination to determine their standing;

and until such credentials are passed upon by the Registration Committee or until examinations are passed in the subjects which may be required, the applicant for admission will ordinarily not be admitted to class work. This means, in the case of graduates from accredited high schools, that diplomas must be brought to the college. In the case of graduates from the eighth grade of the common schools, the certificate of examination must be brought to the college. In case of any work for which any applicant shall ask credit, not covered by a high school diploma or an eighth grade certificate, he must bring a written statement, signed by the president, superintendent, principal, or teacher of the school where the work was taken, showing just what subjects credit is asked for, just how much time was given to such subject, and the grades attained.

Time for Registration.—The time set for registration of students is the first Monday and Tuesday of the first semester, and the first Tuesday of the second semester. The classroom work begins on the first Wednesday morning of each semester. No students will be registered on Wednesday, Thursday or Friday of the first week of each semester, except at the convenience of class officers between four and five in the afternoon. Those who fail to present themselves for registration before the first Wednesday in either semester, will be permitted to register later in the first week, only upon the payment of a special fee of $2.00 in addition to regular fees. Those who apply for registration after the end of the first week of each semester, will be registered only upon payment of a special fee of $4.00 in addition to the regular fees. All special fees so collected shall go into the miscellaneous college fund. The faculty may at its discretion refund the special fee of any student, after the third month of the semester, upon a plain showing that the tardy registration was necessary.

Registration by Mail.—Most of the details of registration can be arranged in advance by mail, and students are requested to arrange their work so far as possible in this way. Those who enter the institution for the first time, should write several days in advance of the college opening, enclosing their credentials, as specified in the paragraph on matriculation above, to the president of the college, and should state the work which they wish to take. These documents will be examined and the student's classification ordinarily be determined before his arrival, so that much time in registration may be saved. Those who have been already enrolled in the institution, should send a letter to their class officers several days in advance of the registration days, telling clearly the work which they plan to take, and in the case of elective subjects, stating briefly the reasons for their choice.

If these steps are taken by students, registration should be completed with a minimum expenditure of time; but no student's registration will be complete until he applies at the college in person.

Students who plan to arrange their registration by mail as specified above, should study carefully the entrance requirements for the courses in which they are interested, and the pre-requisities to the various subjects which they wish to take up.

HOW TO REGISTER.

I. All students who have registered here before—except graduates of the preparatory department registering as freshmen—will go directly to their class officers and obtain a class entrance card.

II. Those who have not registered here before and graduates of the preparatory department will:

(1) Fill out application blank.

(2) Secure the signature of a member of the registration committee.

(3) Take this signed application blank to the class officer in whose course registration is desired.

(4) From him secure a class entrance card.

III. After securing class entrance card pay fees at secretary's office.

IV. Present class entrance card at the office of the registration committee for approval.

V. An approved class entrance card constitutes a ticket of admission to classes.

Unless permission is granted by the faculty, class officers will register all students in accordance with the rules governing pre-requisites, failures and number of credits. The registration committee will examine all credentials for admission, and all grades earned in this and other institutions and report any irregularities in registration to the faculty. No registration shall be considered final until approved by the committee or the faculty.

Amount and Regularity of Work.—Students under twenty-one years of age will be admitted only to regular courses or to work as nearly regular as their preparation allows, unless on special action of the faculty. Students over twenty-one will be admitted to such work, not less than twelve credits, (allowance being made for music) as the schedule permits and their class officers approve.

Change of Registration.—A student desiring to change his studies will present his request to his class officer, who, after consulting all teachers interested, will take such action as he may deem best. Change in registration will be made after four weeks for extraordinary reasons only. Requests for change in registration will not be considered during the last eight weeks of a semester.

A change in course of study is allowed by a vote of the faculty only.

ATTENDANCE.

Attendance.—A student tardy or absent from any class will present the reason for the tardiness or absence at the first appearance at such class after the tardiness or absence has occurred. The teacher will be the judge of the sufficiency of the excuse. A student absent from class the third consecutive time will be reported to the class officer and the president. A student who has been three times absent (two tardiness counting as one absence) and is unable to present a satisfactory excuse

is immediately suspended and will be reinstated only by a vote of the faculty.

Leave of Absence.—When it is necessary for a student to be absent from the city, application must be made to the president for leave of absence. A leave of absence is a justification for absence from class but does not give relief from the work omitted.

GRADES.

Passing Grades.—An average standing from 90 to 100 is A, from 80 to 90 is B, from 70 to 80 is C, from 60 to 70 is D, from 50 to 60 is E, below 50 is F.

All students, one half of whose work shall have received the grade of A, will be recommended for the degree "With Honors."

Conditions and Failures.—An average standing of less than fifty per cent for any semester's work shall be termed a "failure," and the work must be made up by repeating the subject the following year. An average standing for the semester of more than 49 per cent and less than sixty per cent shall be termed a "condition." A condition must be removed by a special examination before the beginning of the semester in which the subject is next taught. If not removed within this limit the condition shall become a failure, to be made up by immediately repeating the subject. Examinations for removing conditions shall be held on the Monday and Tuesday preceding the beginning of the college year, and on the last Friday and Saturday of each semester, and at no other time. Laboratory work falling below the grade in quality or quantity shall be marked deficient and shall be made up within the same time limit as conditions.

Students whose work is unsatisfactory will be reported to the class officer and the president, and information will be sent to the parents or guardians.

Credits. For convenience in estimating the requirements for a degree, the following rules are laid down: One hour a week, for a semester, of recitation or lecture work, or two and one-half hours a week for a semester of laboratory, shop, library work, or drawing, shall count as one credit.

If for any reason the full time is not occupied in the shop, laboratory, drawing room or library, the remainder shall be used under the supervision of the instructor for outside work.

No regular student may take in any one semester work amounting to less than twelve credits, nor more than nineteen, unless a greater number are prescribed in the course.

Grades brought by a student from another institution will be accredited in this college only after personal conference with and approval by the head of the department in which credit is desired.

GRADUATION AND DEGREES.

Bachelor's Degree.—Candidates for the bachelor's degree must com-

plete satisfactorily one of the college courses as outlined and not less than 130 credits; including also a thesis the value of which in credits shall be determined by the instructor concerned. Students who are relieved for any reason of the requirements in military drill shall present four additional credits in some other subjects.

The degree of Bachelor of Science is conferred upon students completing the work prescribed in any one of the college courses and the name of the course taken is placed on the diploma.

Master's Degree.—The candidate must hold a bachelor's degree from this college or another of at least equal rank, and in the line of work for which he applies for the master's degree or he shall have sufficient preparation in his major subject to enable him to carry on research work. He shall complete the full year of resident study of not less than 32 credits.

There shall be one major subject and one or two minors, the major being equal to ten credits per semester. The plan of the work must be approved by the committee on graduate work by October 1. The candidate shall also present a thesis embodying the results of original research which may be part of the credits required for the major subject.

Engineering Degrees.—Resident graduates in engineering may earn the degree of Civil Engineer, of Electrical Engineer, or of Mechanical Engineer, on the same basis as candidates earn the degree of Master of Science. Non-resident graduates in engineering must have at least three years of successful professional experience, must present an acceptable thesis, and must pass an examination before the special committee on degrees.

MISCELLANEOUS.

Government.—Students are expected to conduct themselves as ladies and gentlemen; those who fail to comply with this demand will be requested to leave the institution.

Work for Exhibition.—It is required that students who have done work suitable for exhibition purposes shall place such work at the disposal of the institution for the period of one year.

Assembly.—Students are required to attend the weekly assembly, at which lectures are delivered by members of the faculty and others.

Student Organizations.—All public performances, given by students or student organizations, using the name of the college, will be under the supervision of the committee on student organizations.

So far as possible all college functions will be held on Friday and Saturday evenings. This includes class and student organizations. Students will not be out at nights from Monday to Friday except to attend something of unusual interest and value.

Military Drill.—All male students, except aliens, those physically disqualified, members of the junior and senior classes, and student assistants, are required to take military drill, satisfactory work being requisite for graduation.

Honorable Dismissal.—Students intending to sever their connection with the institution, either indefinitely or permanently, should report as soon as possible to the president, either in person or in writing, giving proper explanation, and should apply for an honorable dismissal. Students leaving the institution without such honorable dismissal (except at the end of the college year), will not be readmitted to the college at any later time, nor will any reports or grades in credit for work done here be sent out until satisfactory explanation is made.

COLLEGE ORGANIZATIONS.

Young Men's Christian Association.—The association is undenominational and is well fitted to promote the moral and religious life of students. It conducts mission and Bible study courses, and prayer meetings and secures addresses by religious workers. The association promotes good fellowship by giving social entertainments, assists new members to get started in college life and aids in securing employment for those who wish to work their way through college.

Young Women's Christian Association.—The object of this association is the all around development of Christian womanhood. It cooperates with the Y. M. C. A. in its social and religious work among the students. It conducts devotional meetings and carries on systematic Bible study. Several delegates are sent to the Northwest Conference each year and an active interest is maintained in the state association.

Both associations have neatly furnished rooms in which to hold meetings and transact business.

Literary Societies.—Two literary societies are maintained, the Arena for college students and the Philomathion for preparatory students. They give most excellent opportunity for practice in composition, declamation, oratory, and debate.

Engineering Society.—The object is to aid its members financially by purchasing at wholesale rates, books, materials and instruments.

Agricultural Society.—All agricultural students are eligible to membership in this society. Regular meetings are held for the discussion of topics of interest to students in agriculture. The aim is to create a professional interest in scientific agriculture with special reference to the possibilities of farm life. A bookstore for the members has been conducted during the past year.

The Exponent.—The students of the college maintain an excellent weekly paper, The Exponent, which has also a monthly literary supplement. The paper is well supported by the students and outside advertisers and has become one of the most important and successful of student enterprises. It compares favorably with the best college publications in the United States and affords the members of the staff very valuable literary training.

Athletic Association.—This association has general control of all thletic interests of the college, subject to the approval of the faculty. Football, base ball, basket ball, track and tennis are maintained. A

part of the annual matriculation fee is appropriated to athletics and all students thus become members of this association without additional cost.

Pharmaceutical Society.—The society was organized for the purpose of arousing a greater interest in scientific matters of practical importance to the pharmacist. Monthly meetings are held and current events in pharmacy are discussed and scientific papers and talks are presented by the instructor, students, practical pharmacists, and others.

Branch of the American Institute of Electrical Engineers.—A branch of this society has been organized at the college. Regular monthly meetings are held at which original papers are read or those of the Institute discussed. Students and teachers are kept in touch with practical engineers and their problems. Only regular members or student members of the American Institute are eligible to membership in this branch. There is, however, an Electrical Club which includes all the members of the Institute and all other students in the electrical engineering course.

The Civil Engineering Society.—The students of the department of civil engineering organized the society for the purpose of promoting their interests in matters of practical importance to engineering students and alumni. Prominent engineers who have succeeded in special fields frequently meet with the members of the society to discuss the problems of their field. Meetings are held bi-monthly.

College Band.—The college band of forty-five members, under the instruction of Mr. Louis Howard is one of the best amateur musical organizations in the state. The college provides instruments, music and instruction. The band is divided into two sections, beginners and experienced players. This gives a splendid opportunity both for those who have never played and those who have some skill in the use of instruments.

College Choristers.—This glee club of twenty-four voices has attained a high degree of skill in rendering popular and high class music. The annual concert is one of the chief events of the college year. A splendid opportunity is given students to cultivate their musical talent.

CONTESTS.

Prize in Oratory.—An annual prize of twenty dollars is given to the winner in the annual local oratorical contest. This is open to all students. The winner represents the college in the state oratorical contest.

Armstrong Prize in Declamation.—Hon. F. K. Armstrong, of Bozeman gives a prize of ten dollars to the winner of the annual declamatory contest of the preparatory school. There is also a second prize of five dollars. Only regular students are eligible.

SCHOLARSHIPS.

The State Board of Education has established a four year scholarship in each of the accredited high schools for the student who receives the highest average grade in his class. These scholarships are awarded

each year by the high school principals for their respective schools. This scholarship excuses the holder from paying any tuition or deposits. Any one winning a scholarship may choose any of the state institutions.

ACREDITED HIGH SCHOOLS.

Following is a list of the accredited high schools of the state:

(1) **City High Schools.**—Anaconda, Billings, Butte, Chinook, Columbus, Forsyth, Fort Benton, Glasgow, Great Falls, Hamilton, Havre, Helena, Pony, Whitehall and Virginia City.

(2) **County High Schools.**—Beaverhead, Dillon; Broadwater, Townsend; Carbon, Red Lodge; Custer, Miles City; Dawson, Glendive; Fergus, Lewistown; Flathead, Kalispell; Gallatin, Bozeman; Granite, Philipsburg; Jefferson, Boulder; Missoula, Missoula; Park, Livingston; Powell, Deer Lodge; Sweet Grass, Big Timber; Teton, Choteau.

(3) **Parochial High School**, Butte; Sacred Heart Academy, Missoula.

EMPLOYMENT FOR STUDENTS.

A number of students earn a part of their expenses while in college. Students expecting to work their way should come with sufficient money to pay their expenses for one semester unless they have engaged work in advance. The college cannot guarantee employment, but those who are willing to give efficient, faithful service have usually found work.

A few students are employed as janitors and as assistants in the shops, laboratories and barns. Others care for furnaces, horses and cows in the city, work in stores and at various kinds of house work. Calls for young lady students to work for their board are numerous.

Students readily find employment at profitable wages during the summer vacation. A large number annually get work with the transportation companies in the Yellowstone National Park as drivers, camp-attendants and domestics. Engineering students are placed with the reclamation service, the railroads, and the electric power plants.

A faculty committee aids students to find employment. Those desiring work should write, stating experience and kind of work desired.

LIBRARY AND READING ROOM.

Public Depositary.—By Act of Congress the library is now a depositary and receives all public documents and other printed matter issued by the United States government.

Main Library.—The main library is in two large, well lighted rooms on the first floor of College Hall. The library contains 11,300 volumes, not counting public documents, and about 6,000 pamphlets. It is well supplied with standard works in technology, history, science and literature, as well as with dictionaries, cyclopedias and other reference works. About $1,500 is spent annually for books and periodicals.

Department Libraries.—The agricultural library occupies two rooms on the second floor of the Agricultural Hall. It contains almost com-

plete bound sets of all state experiment station bulletins and United States Department of Agriculture publications, besides a large number of agricultural papers and standard works. One large room on the first floor of the biology building is used for the library and periodicals of the biological department. The library of the chemistry department is located in the office of the chemist in the chemistry building.

ATHLETICS AND PHYSICAL TRAINING FOR MEN.

J. H. McIntosh.

The gymnasium is described on page 11 of this catalogue. This furnishes some room for basketball practice and games, for baseball and football practice in bad weather and for gynasium practice of various kinds during the winter months. A small amount of apparatus is available. The college furnishes the necessary equipment and materials for basketball, football, baseball and track athletics.

The work of this department includes three main lines—the coaching of athletic teams to represent the college in outside contests; the training of such men as present themselves during the winter for work in wrestling, boxing and indoor work; and the general supervision of the physical welfare of all the students through a system of physical examination and prescribed exercises.

The college has been represented in inter-collegiate athletics during the past year by teams in basketball, track athletics, baseball, and football. All have done creditable work. Eligibility in these teams is determined under the rules of the Montana Inter-Collegiate Athletic Association.

The gynasium work is open to all the students of the college and the preparatory school and a good deal of interest has been aroused. Wrestling and boxing matches have been used to entertain the spectators between the halves of basketball games.

At the middle of each college year all the students of the college are requested to present themselves for a thorough physical examination; and on the showing thus made the instructor prescribes certain forms of exercise for each student, and makes certain recommendations regarding diet and hygiene. At each recurring annual examination the improvements are noted and further suggestion made.

Athletic Field.—The new athletic field located south of the main building has been completed during the year. It consists of a quarter mile 20 foot cinder running track with a 130 yard straight-away. The inside field is graded for use as a foot ball gridiron and base ball diamond. A neatly constructed grand stand with a seating capacity of 500 has been provided. During this summer the entire field will be surrounded by a substantial iron and wire fence. There are two good tennis courts, one clay, the other cement.

PHYSICAL EDUCATION FOR WOMEN.

Mrs. Una B. Herrick.

The aim of the physical education department for women is to develop each girl to her highest economic value, as a unit of society, to the end that when she finishes her college course she may carry forth into life a sane, well balanced, logical mind, high moral character, and a strong symmetrical properly functioning body, capable of assuming and performing cheerfully and well the duties of cultured womanhood.

First Year.—Physical examination on entering. The chief aim throughout the year is to establish good posture and carriage and strengthen vital functions. The work will consist of Swedish body building work, some floor tactics, German rhythmic dancing and games.

Class exercises twice a week required.

Second Year—The work for second year students will be built on first year's work. Light apparatus, folk dancing, gymnasium games.

Class exercises twice a week required.

All through the three years the course includes lectures on personal hygiene; general deportment for girls; dress from the standpoint of health and appearance; the physiology of bodily exercise. The regulation gymnasium suit and shoes, which may be obtained from a local dealer will be required.

BASKET BALL TOURNAMENT AND SPEAKING CONTEST.

The first high school basket ball tournament was held at the college March 2, 3 and 4, 1911. Sixteen Montana accredited high schools were represented by teams. The railroad fares for six players together with rooms and board for three days in Bozeman were paid by the college. A cup was awarded to the champion team. Rules of eligibility were determined and protests decided by the representatives of the Montana high school athletic association. In connection with the basket-ball tournament an extemporaneous speaking contest was held. Fifteen high schools participated. One representative from each school had expenses paid the same as for the tournament. It is intended to make both of these contests an annual affair, and invitations have been issued for the corresponding week in March 1912.

ORGANIZATION OF INSTRUCTION.

A. The following four year college courses, each leading to the degree of Bachelor of Science, are offered:

1—Division of Agriculture.

1, Agronomy; 2, Animal Industry and Dairying; 3, Horticulture.

2—Division of Engineering.

1, Civil Engineering; 2, Electrical Engineering; 3, Mechanical Engineering.

3—Division of Science.

1, Biology; 2, Chemistry; 3, Home Science; 4, History-Literature; 5, Mathematics-Physics; 6, Secretarial.

B. The following courses, not leading to a bachelor's degree are offered:

1—Preparatory School.
2—School of Agriculture.
3—School of Pharmacy with the degree of Ph. C.
4—Art School.
5—Music School.

C. The following special courses are offered:

1—Household Economy.
2—Dairying.
3—Livestock.
4—Poultry.
5—One Week Course for Women.

Notation.—In the following tables and description of courses the signs used are as follows: All numbers given in the parentheses are the numbers of the courses and the description of the work may be found by these numbers. So the notation (Math. 3) means that the course referred to is the course in mathmatics numbered 3 which is analytical geometry and calculus. The letters of the alphabet without numbers are used in parentheses in the same way to indicate courses of sub-freshman rank. The arabic numbers used without parentheses in the tables and in the description of the courses indicate the number of credits toward graduation allowed for the subject. In the description of the courses the roman numerals, I and II are used to designate the first and second semesters. M., T., W., Th., F., and S., are used to indicate the working days of the week, and the numerals "10 to 11" or "3 to 4" to indicate the morning or afternoon hours. In the case of elective subjects, no hours are given. The time of the recitations for elective subjects will be announced as the work is called for.

Division of Agriculture

Four year courses are maintained in (1)Agronomy, (2) Animal Industry and Dairying, (3) Horticulture. The aim is to give a scientific and practical training for the agriculturist, the stockman, the dairyman and the horticulturist. The work is the same for the first two years. At the beginning of the junior year the student chooses the group in which he desires to specialize. The completion of the new agricultural building, the purchase of additional lands, and the erection of farm buildings and barns, afford ample accommodation for the agricultural work. The equipment and other facilities are described in connection with the courses of study.

AGRICULTURE.

FRESHMAN YEAR.

First Semester		Second Semester	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (Eng. 4)	1	Public Speaking (Eng. 4)	1
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
General Botany (Biol. 9)	5	Plant Physiology and Histology (Biol. 10)	4
Trig. and Log. (Math. 2a)	3	Prin. Plant Culture (Hort. 1)	4
Farm Dairying (An. Ind. 8)	3	Animal Types (An. Ind. 1)	3
Drill	1	Drill	1
	19		19

SOPHOMORE YEAR.

Expository Composition (Eng. 2)	2	Expository Composition (Eng. 2)	2
Qualitative Analysis (Chem. 2)	4	Organic Chemistry (Chem. 5)	5
Gen. Des. Phys. (Phys. 1a)	3	Gen. Des. Phys. (Phys. 1a)	3
Invertebrate Zoology (Biol. 1)	4	Animal Phys. and Anat. (Biol. 3)	5
Field Crops (Agron. 1)	5	Geology (Geol. 1)	3
Drill	1	Drill	1
	19		19

Course in Agronomy

Agronomy is the science of the field and its crops. It treats of the production and improvement of field crops, the cultivation of soils and the maintenance of their fertility, and general farm management, which is the application of economic business methods to farm practices.

Because of the peculiar agricultural conditions existing in western states, a new agriculture is being developed. The handling of dry farming lands is necessary only in the West. The problems which have to do with irrigation water, and the cultivation of the soil and management of the crops under irrigation must be solved by western investigators and agriculturists. It is to fit men to deal with these and other questions of production on the farm that this course is offered.

The first two years of the agronomy course are devoted to the study of the natural sciences, languages and some general agricultural work. This places the student in a position to appreciate and intelligently discuss the methods of practice taken up later in the course.

The last two years of the course are designed to give the student clear insight into methods for the cultivation and maintenance of the fertility of the soil; the peculiarities of the growth and handling of different crops; the arrangement, the laying out of the farm, and the principles which govern successful farm management.

With a constantly growing appreciation of the value of the agricultural lands of the West, comes an active demand for young men trained along the lines of practical and scientific agronomy, men who combine college training with practical experience and native ability. Such training is offered to young men in this course. The demand for such students is unlimited, at a compensation not exceeded in any other calling. A few of the many lines open to graduates of this department are: college and experiment station work, agricultural journalism, management of large irrigated and dry farms, management and salesmanship for seed firms, and superintendencies for companies with large land holdings.

AGRONOMY.

JUNIOR YEAR.

First Semester		Second Semester	
Economics (Econ. 3)	2	Economics (Econ. 3)	2
Soil Physics (Agron. 2)	5	Soil Fertility (Agron. 3)	3
Agricultural Chemistry (Chem. 7)	4	Farm Mechanics (Agron. 4)	3
Bacteriology (Biol. 12)	5	Plant Pathology (Biol. 11)	4
Elective	2 or 3	Care and Management of Live Stock (An. Ind. 6)	3
		Elective	2
		Organic Evolution (Biol 14)	2
	18 or 19		19

SENIOR YEAR.

Farm Management (Agron. 6)	4	Principles of Breeding (Agron. 7)	4
General Entomology (Biol. 4)	4	Soil Management (Agron. 8)	2
Plane Surveying (C. E. 1)	5	Sanitary Science (Vet. Sci. 6)	2
Thesis (Agron. 9)	2	Feeding Live Stock (An. Ind. 4)	3
Elective	4	Advanced Grain Judging (Agron. 5)	2
		Thesis (Agron. 9)	2
		Elective	4
	19		19

Course in Animal Industry and Dairying

The work in animal industry consists of study in judging, feeding, breeding and caring for farm animals. The work in dairying consists of the handling, manufacture and marketing of milk and its various products.

This course is designed to prepare young men for agricultural college and experiment station work, federal government work, farmers' institute work, positions as buyers and salesmen of livestock, teachers of animal industry and dairying in high schools, managers of large livestock and dairy farms, creamery and dairy inspectors, managers of dairy corporations, and community milk depots; and above all, to furnish men with a scientific as well as a practical knowledge to operate their own farms in Montana.

The first two years of this course are given largely to a study of basic subjects, as English composition, mathematics, physics, chemistry, and biology. The last two years are given to special practical and theoretical work in dairy manufactures, handling of milk, judging and feeding live stock, veterinary science, bacteriology and other allied subjects.

This course is given through text books, lectures, practice and observation. Lectures are given by specialists and the student is made familiar with the most modern ideas and acquainted with the methods of the most successful breeders, feeders and dairymen in this and European countries. The work in judging is given by the use of college animals and stereopticon lectures. To secure a variety of animals, excursions are made to stock farms near the college. Advantage is also taken of the live stock on exhibition at the state and local fairs. Practical instruction is also given in compounding rations, making out pedigrees and keeping breeding records.

The theoretical work in dairying is closely followed with practical work in handling separators, testing milk, ripening and churning cream, and by all the actual work in the college creamery and cheese factory. The practical and theoretical are carefully combined.

ANIMAL INDUSTRY—DAIRYING.

JUNIOR YEAR.

First Semester		Second Semester	
Agricultural Chemistry (Chem. 7)	4	Animal Nutrition (Chem. 11)	3
Breeds of Live Stock (An. Ind. 2)	4	Poultry (An. Ind. 7)	3
Milk & Milk Testing (An. Ind. 9)	3	Veterinary Anatomy (Vet. Sci. 2)	3
Bacteriology (Biol. 12)	5	Vertebrate Zoology (Biol. 2)	4
Veterinary Physiology (Vet. Sci. 1)	3	Organic Evolution (Biol. 14)	2
		Dairy Manufactures (An. Ind. 10)	4
		or Soil Fertility (Agron. 3)	3
	19		18 or 19

SENIOR YEAR.

Care and Management of Live Stock (An. Ind. 6)	3	Care and Management of Live Stock (An. Ind. 6)	3
Obstetrics (Vet. Sci. 4)	4	Principles of Breeding (Agron. 7)	4
Stock Judging (An. Ind. 3)	2	Stock Judging (An. Ind. 3)	2
Herd Books and Pedigree (An. Ind. 5)	1	or Cheese Making (An. Ind. 11)	3
Embryology (Biol. 13)	4	Pathology (Vet. Sci. 3)	3
Thesis (An. Ind. 12)	2	Feeding of Live Stock (An. Ind. 4)	3
Elective	4	Thesis (An. Ind. 12)	2
		Elective	2 or 3
	20		20

Horticulture

The four years' course in horticulture, leading to the degree of Bachelor of Science in horticulture, is designed to prepare students as teachers in agricultural colleges, investigators in the agricultural experiment stations, editors of horticultural papers, managers of fruit associations and superintendents of commercial orchards and fruit plantations. The western United States leads the world in methods of orcharding and disposing of orchard products, and there is a strong and growing demand for persons properly trained to manage the orchard projects now operated throughout the fruit regions of the west. Fruit growing, when done in a scientific way, is extremely profitable and presents an inviting field for the trained horticulturist. The college offers good facilities for a thorough training in all branches of horticulture.

HORTICULTURE.

JUNIOR YEAR.

First Semester		Second Semester	
Economics (Econ. 3)	2	Economics (Econ. 3)	2
Soil Physics (Agron. 2)	5	Soil Fertility (Agron. 3)	3
Bacteriology (Biol. 12)	5	Plant Pathology (Biol. 11)	4
Agricultural Chemistry (Chem. 7)	4	Vegetable Gardening and Small Fruit Culture (Hort. 3)	5
Pomology (Hort. 2)	3	Organic Evolution (Biol. 14)	2
		Elective	3 or 4
	19		19 or 20

SENIOR YEAR.

General Entomology (Biol. 4)	4	Landscape Gardening (Hort. 6)	3
Systematic Pomology (Hort. 4)	3	Greenhouse Construction and Management (Hort. 5)	3
Commercial Fruit Growing (Hort. 7)	3	Principles of Breeding (Agron. 7)	4
Plane Surveying (C. E. 1)	5	Sanitary Science (Vet. Sci. 6)	2
Thesis (Hort. 8)	2	Thesis (Hort. 8)	2
Elective	3	Elective	3 or 4
	20		17 or 18

AGRONOMY.

Professor Atkinson,
Assistant Professor Patterson,
Mr. Bonebright.

On the main floor of Agricultural Hall are the soil and grain laboratories and class rooms modern and thoroughly equipped.

The soil laboratory accommodating forty-eight students, provides for accurate work in soil physics and soil fertility. Upwards of two thousand dollars have been expended in equipping these laboratories with the most up-to-date fittings and apparatus, in order that the students may enjoy the very best facilities.

In the grain laboratory specially designed individual judging tables have been installed. This permits each student to pursue careful and continuous work in grain judging and enables him to become thoroughly familiar with the various grain standards. Vermin proof storage cases for class materials and standard samples have been provided. These insure the preservation of valuable material as accumulated. Score cards based on Montana conditions have been prepared for wheat, oats, barley and corn, and are used to impress students with the points to be looked for in grain judging work.

A portion of the space in the greenhouses is given over to pot culture and germination work. Plots on the college farm are available for student work.

(1) **Field Crops.**—A study of grain crops, root crops, sugar, fibre and other classes of field crops which may be grown in Montana. The history, classification, management, uses and the possible manufactured products are fully discussed. In this course the students become familiar with the various commercial grain standards and have considerable grain judging practice with the score card. Lectures 3; laboratory 2; I, 5. M. W. F., 9 to 10, T. Th. 8 to 10.

(2) **Soil Physics.**—This course is designed to prepare the students to understand better the effects of the different methods of treating soils, and the influence of these upon moisture, texture, aeration, fertility and production. It comprises a review of the origin, formation and classification of soils and study of the conditions influencing the supply of heat, air and moisture as related to growing plants. The work of the class room is supplemented by laboratory work comprising the determination of such questions as the water holding capacity and capillary power of various soils, and the effect of mulches and of various systems of rotation on the physical condition of the soil. Lectures 3; laboratory 2; I. 5. M. T. Th. 10 to 11. T. Th. 1 to 3.

(3) **Soil Fertility.**—Maintenance of fertility, fertilizers and rotation. The influence of barnyard manure, green manuring and commercial fertilizers upon the quality and yield of the various crops. The effects of different crops upon the fertility of the soil and upon succeeding crops, different rotations and the ultimate effect of different methods of

farm management upon the fertility and productive capacity of the soil, and also a study of the preservation of barnyard manure. II, 3. M. W. F., 9 to 10.

(4) **Farm Mechanics.**—Includes the study of the development, construction, functions and methods of operating, adjusting and repairing implements and farm machinery; also a study of the principles of draft and the production of power, and the care and operation of such farm power machinery as the windmill, gasoline engine, and the different makes of traction plowing machinery. Lectures 2; laboratory 1; II, 3. W. F. 10 to 11. Th., 8 to 10.

(5) **Advanced Grain Judging.**—In this course is given constant practice in judging cereal, grass and forage seeds. Two hourse credit. Prerequisite agronomy (1). Laboratory 2. II. T. Th. 1 to 3:30.

(6) **Farm Management.**—This course considers the problems of farm mangagement. The relative profits of different systems of farm management the relation of the industry of agriculture to other industries, and the social conditions of agriculture are considered. I, 4. M. T. W. Th., 11 to 12.

(7) **Principles of Breeding.**—This course considers the different theories of plant and animal improvement, and embraces a study of selection, heredity, variation, atavism and fecundity; also cross breeding and in-and-in breeding, with a historical study of their results. II, 4. M. T. W. Th., 11 to 12.

(8) **Soil Management.**—This course includes a study of the most approved methods of handling various soils in their relation to crop production. It embraces a study of alkali, sandy, heavy clay, gumbo, muck, peat and old worn out soils, as well as a study of the management of irrigated and dry farm lands. II, 2. T. Th., 9 to 10.

(9) **Thesis.**—Agronomy students are required to prepare a graduating thesis on some subject to be approved by the head of the agronomy department. The subject of this thesis must be decided upon not later than November 15th, of the senior year, and the thesis must include considerable research and experimental work on the part of the student. I and II, 4.

ANIMAL INDUSTRY AND DAIRYING.

Professor Clark,
Assistant Professor Jones,
Mr. Schoppe.
Mr. Griffin.

For the work in animal industry there is available a herd of thirty-five dairy cows, herds of pure bred cattle, Herefords, Shorthorns, Angus, Holsteins, Ayrshires and Jerseys, Percheron horses, pure bred Berkshire, Poland China and Yorkshire swine, and Shropshire, Rambouillet and Cotswold sheep. During the winter season the live stock used in the feeding experiments is also available for study. For the poultry work nine breeds of fowls are kept.

The cattle barn is a two story frame building with two wings extending to the south. One of these wings is used for the dairy cows and breeding stock, and the other for bulls, young stock and calves. Between these two rooms is located a stock judging pavilion forty feet square. The second story of the main barn is used for the storage of hay. The first story provides feeding rooms, storage for grain and box stalls.

The horse barn is a two story frame building with stalls for twenty horses, carriage and feed rooms, and capacity of 100 tons of hay.

The piggery consists of a main building thirty by thirty-five feet, with two wings sixteen by fifty feet each. In the main building are the feeding rooms and slaughter room, while the wings provide six pens each.

The poultry buildings include two main buildings, one seventy-two by sixteen feet, with twelve pens; the other one hundred and twenty-eight feet long with eight pens; with yards one hundred feet long on either side, and a brooder house thirty-six by sixteen feet. These buildings are connected by a feed room, fourteen by twenty feet, under which is an incubator cellar and a heating plant for the building.

The dairy is equipped with all modern appliances for the manufacture of butter and cheese. Eight hand separators afford the students an opportunity to compare the merits and demerits of the different types.

In churns there are the Perfection, Disbrow and Simplex. These are all combined churns and butter workers, yet are entirely different in style. In addition, the butter room is equipped with all modern appliances for handling milk and cream, such as cream vats, tempering vats, Wizard and Jensen ripeners, starter cans, and Bohn refrigerator together with all things necessary for the manufacture of butter in an up-to-date plant.

The creamery is equipped with a 5 horse power boiler and a 5 horse power electric motor, and in the practical work each student takes his turn in handling these machines.

The cheese room is 30 by 30 feet with curing rooms 20 by 20 feet; in the former there are cheese vats, gang and upright presses and all necessary hoops and equipment for the manufacture of all varieties of American Cheddar cheese. In this department there is made both Edam and Brick cheese, but special emphasis is placed on the manufacture of the American cheese.

The testing laboratory is very thoroughly equipped with different styles of Babcock testers (both hand and steam) and all necessary glassware for the testing of milk, cream, butter, cheese, skim milk, whey, etc. Different tests for the determination of moisture in butter have been added as well as a complete equipment for acidimetry.

(1) **Animal Types.**—A study of types as related to production and work. This course covers the judging of the different market classes of cattle, (beef and dairy), of sheep, (mutton and wool), of horses, (light and heavy), and of hogs, (bacon and fat). The entire time of this course

is given to practical handling and judging of the stock in the stock pavilion. Laboratory 3; II, 3. T. W. Th., 1 to 3:30.

(2) **Breeds of Live Stock.**—A study of the development of the breeds of horses, cattle, swine and sheep will illustrate the principles and particular characteristics, and distinguish one breed from another, and will show the adaptability of each particular breed to various climates, conditions and purposes. These lectures will be illustrated by steropticon views of characteristic animals of the different breeds. Lectures, 3; laboratory, 1. I, 4. M. 11 to 12. T. Th. 10 to 11. Th. 1 to 3:30.

(3) **Stock Judging.**—Animal measurements and the systematic study of animal form, function, and performance; the aim being to give exact and intimate acquaintance with the detailed form of specialized types, a knowledge that is essential to the highest success in selection and breeding; also some systematic work in the judging of groups of cattle, horses, sheep and swine, similar to those found at county and state fairs. Lecture, 1; laboratory, 1. I and II, 4.

(4) **Feeding Live Stock.**—The principles underlying the profitable feeding of animals. The composition of plants, animals and animal products. The practice that gives best results as indicated by available data gathered from the work of experiment stations in this and other countries. II, 3.

(5) **Herd Books and Pedigrees.**—This is largely a laboratory study of the herd books of different breeds of live stock. The tabulation of pedigrees is practiced, and such other exercises as will enable the student to learn the value of a pedigree and show how to keep the record of a breeding herd. I, 1.

(6) **Care and Management of Live Stock.**—A special study of the methods to be followed in the breeding, feeding and development of the various classes of live stock as illustrated from the practices of the most successful stock breeders. Lectures 2; laboratory 1; I and II, 6. T. Th., 9 to 10. M., 1 to 3:30.

(7) **Poultry.**—Breeds and management; poultry houses; feeding and care of poultry; the operation of incubators and brooders. II, 3.

(8) **Farm Dairying.**—This course comprises a study of the subject of dairying and its general relation to the farm. The class of work takes up production of milk, separation of cream by gravity and separator; the preparation of starters; the ripening and churning of cream; the packing and marketing of butter. The use of the Babcock tester is also discussed with particular reference to its use on the farm; also the construction of the milk house and stables with regard to sanitary conditions as well as to utility. Lectures, 2; laboratory, 1. I, 3.

(9) **Milk and Milk Testing.**—This course comprises a study of milk, its secretion, composition, and uses; pasteurization; separation and handling for city milk trade; the care of milk for creamery or cheese factory; the testing of variations and adulterations; the testing of butter and cheese; and the use of the acidimeter. Reference books used: "Milk

and Milk Testing,'' by Farrington & Wall; ''Modern Methods of Testing Milk and its Products,'' by Van Slyke; and ''Dairy Laboratory Guide,'' by Melick. Lectures, 2; laboratory, 1. I, 3. M. W. F., 9 to 10. M. 1 to 3:30.

(10) **Dairy Manufactures.**—This course comprises advanced work in butter making, the scoring of butter and cheese, factory management and accounting, milk inspection, and the preparation of ice cream and ices.

This course is also intended to give the student a general knowledge of the different ways in which milk and its products are utilized outside of the scope ordinarily considered under dairying; such subjects as the preparation of condensed, certified, modified, and hygienic milk. Referencee books used: ''The Principles and Practices of Butter Making,'' by McKay and Larson; and ''Jensen's Milk Hygiene,'' by Pearson. Lectures, 1; laboratory, 3. II, 4.

(11) **Cheese Making.**—The equipment for factory and home cheese making, the principles and practice necessary to make a uniform article and methods used to overcome characteristic difficulties are explained and illustrated in the class room and laboratory. All common varieties of cheese, such as Cheddar, Swiss, Brick and Limburger, are discussed, and as far as possible made in the cheese room, but the Cheddar cheese making is particularly emphasized. Reference books: ''Cheese Making,'' by Decker; and ''The Science and Practice of Cheese Making,'' by Van Slyke & Publow. Laboratory, 3. II, 3.

(12) **Thesis.**—During the senior year each student is required to prepare a thesis. This must be orignal work by the student, who must consult with the instructor in charge regarding subject. I and II, 4.

HORTICULTURE.

Professor Whipple.
Mr. Schermerhorn.

(1) **Principles of Plant Culture.**—This course deals with the principles of plant culture, beginning with the germination of seeds; the selection and storing of seeds; the growth of plants as influenced by their environments; the physiology of the growth of plants; the functions of different parts of plants; methods of production; the fruiting of plants as influenced by culture, etc.; the plant as affected by heat, cold, excessive water, light, lack of food, etc.; the principles and practice of propagation other than seeds; transplanting; and the elements of pruning. The work is taken up in text book, lectures and practice work. II, 4. M. T. W. Th., 11 to 12.

(2) **Pomology.**—This course is designed for horticulture students, and deals with the principles and practice of pruning of tree-fruits, grapes and small fruits; the physiology of pruning; the fruit bearing habits of plants and their relation to pruning; the effect of ringing, bending and thinning fruit; pruning young trees, dwarf trees and mature

trees—these subjects will be treated in text book, lectures and practice work. Hort. (1); prerequisite, I, 3. M. W. F., 9 to 10.

(3) **Vegetable Gardening and Small Fruit Culture.**—This course deals with the principles of vegetable gardening and small fruit culture, as well as with the practical side of the subjects. The growing of vegetables in the garden and greenhouse will be discussed. The growing of small fruits adapted to Montana conditions will be taken up in detail. The subjects will be treated in text book, lectures and practice work. II, 5. M. T. W. Th. F., 9 to 10.

(4) **Systematic Pomology.**—This course takes up the systematic side of pomology, the desciption and naming of varieties of fruit. Considerable time will also be devoted to the judging of exhibition fruit and discussion of score cards. The latter part of the course will be devoted to a study of the evolution of cultivated plants, especially fruits. Lectures, 2; laboratory, 1. I, 3.

(5) **Green House Construction and Management.**—The construction, heating and maintaining of greenhouses, with lectures and practice treating of the methods of growing plants in greenhouses and conservatories. II, 3.

(6) **Landscape Gardening.**—The laying out and planting of private and public grounds are discussed. The trees, shrubs and flowers suited to Montana conditions are studied. Lectures, 2; laboratory, 1. II, 3.

(7) **Commercial Fruit Growing.**—In this course the methods of planting, cultivating, irrigating and managing commercial orchards are discussed in the class room and orchard. The methods of picking, grading, packing and marketing fruits are important phases of the course. Lecture, 2; laboratory, 1. I, 3. T. Th., 8 to 9.

(8) **Thesis.**—Horticultural students are required to prepare a thesis during the senior year, two credits running throughout the year being allowed for this work. The subject of the thesis must be approved by the head of the horticultural department and must be decided upon not later than November 15th of the senior year. I and II, 4.

VETERINARY SCIENCE.

Dr. Taylor.

(1) **Veterinary Science.**—A course in animal physiology dealing with the prehension of foods as observed in the various domestic animals. Also the digestion, assimilation and uses of the various foods, the circulation of the blood and its function, the nervous system, the sense of sight and the phenomenon of locomotion. Biology (2) prerequisite. Text book, "A Manual of Veterinary Physiology," by Captain F. Smith. I, 3.

(2) **Anatomy.**—Lectures and laboratory work dealing with the bony framework of the body and its muscles. Special emphasis is laid upon a thorough study of the thoracic and abdominal organs and organs of reproduction. Veterinary Science 1 prerequisite. Text book, Chauveau's "Comparative Anatomy of the Domesticated Animals." II, 3.

(3) **Pathology.**—This course is designed to make the student famil-

iar with the normal and pathological tissues. Gross and micrascapical specimens will be used for demonstration. Vet. Sci. (2) prerequisite. II, 3.

(4) **Obstetrics.**—Diseases of animals incident to reproduction. Emphasis will be put especially upon normal presentations and reduction of dystokia. Veterinary Science (2) prerequisite. Text book, Williams's "Veterinary Obstetrics." I, 3.

(5) **Materia Medica.**—A comprehensive study of the combination of the more common drugs in the treatment of farm animals. Biology (9) prerequisite. I, 2.

(6) **Sanitary Science.**—This course deals with the care and handling of animals affected with communicable diseases. It will also include a few lectures upon sanitary police, on inter-state shipment, and on farm sanitation. Text book, Law's "Veterinary Medicine," Vol. IV. II, 2. T. Th., 10 to 11.

(7) **Common Diseases of Animals.**—On the causes, prevention and treatment of the more common diseases of animals. II, 3.

Division of Engineering

The purpjose of the courses offered in the division of engineering is to furnish the student the fundamental training essential to a successful engineer. This result is accomplished, not alone by the study of the theoretical, but by giving attention to the practical application of the principles involved. A limited degree of flexibility is given in some of the courses through electives, thus enabling the student to specialize in any chosen line of work.

Courses are offered in civil engineering, electrical engineering and mechanical engineering, leading respectively to the degree of Bachelor of Science in civil, electrical and mechanical engineering, and post graduate courses leading respectively to the degree of Civil Engineer, Electrical Engineer and Mechanical Engineer.

Civil Engineering

This course is designed to prepare the student to practice the profession of Civil Engineering in its following branches: Structural and Architectural Engineering; Street, Highway and Railway Engineering; Water Power Development; Irrigation, Drainage and Water Supply Engineering; City Engineering; Sanitary Engineering; Plotting, Mapping, Surveying, etc. The technical subjects which give proficiency in the above branches are supplemented by a thorough study of capital, labor and labor organizations, banking, cost, cost keeping, contracts, specifications, and other legal phases of engineering. Consequently the graduate is enabled to gain compensation, not only through wages and fees, but also as an engineering promoter, as a contractor, or as a consulting engineer.

Each student is expected to engage in practical engineering work during his summer vacations, and is assisted in securing such positions as he may be able to fill.

CIVIL ENGINEERING.

FRESHMAN YEAR.

First Semester.		Second Semester.	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Algebra (Math. 1)	3	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Descriptive Geometry (M. E. 3)	5
Public Speaking (Eng. 4)	1	Public Speaking (Eng. 4)	1
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
Elementary Drawing (C. E. 2)	3	Concrete & Cement (C. E. 15)	2
Woodwork † (M. E. 2)	2	Military Drill	1
Foundry † (M. E. 4)	1		
Military Drill	1		
	19		19

SOPHOMORE YEAR.

English Composition (Eng. 1)	2	Calculus (Math. 4)	5
Calculus (Math. 4)	5	Electrical Machinery (E. E. 1)	2
General Physics (Phys. 1)	3	General Physics (Phys. 1)	3
Physical Measurements (Phys. 2)	2	Physical Measurements (Phys. 2)	2
Plane Surveying (C. E. 1)	5		
Photography (Chem. 4)	2	Railway Engineering (C. E. 4)	6
Military Drill	1	Military Drill	1
	20		19

JUNIOR YEAR.

Mechanics (C. E. 5)	4	Mechanics (C. E. 5)	4
Hydraulics (C. E. 8)	3	Strength of Materials (M. E. 14)	1
Seminar (C. E. 12)	1	Structural Engineering (C. E. 13)	6
Irrigation Engineering (C. E. 9)	3	Sanitary Eng. (C. E. 14)	3
*Field Practice (C. E. 11)	4	Seminar (C. E. 12)	1
*Least Squares (Math. 5)	2	*Light and Sound (Phys. 3)	2
*Cost of Construction (C. E. 25)	2	*Geology (Geol. 1)	3
**Biology (Biology 9)	5	**Organic Chemistry (Chem. 5)	5
**Qualitative Analysis (Chem. 2)	4		
	19 or 20		20

SENIOR YEAR.

Economics (Econ. 3)	2	Economics Econ. 3)	2
*Geodetic Surveying (C. E. 17)	2	Contracts and Specifications (C. E. 23)	3
Water Power Dev. (C. E. 18)	3	Municipal Engineering (C. E. 3)	3
Engineering Design (C. E. 19)	3	Engineering Design (C. E. 19)	3
Seminar (C. E. 12)	1	Seminar (C. E. 12)	1
Found. and Masonry (C. E. 21)	3	*Practical Astronomy (C. E. 24)	2
*Field Practice (C. E. 20)	2	**Water and Air Analysis (Chem. 10)	2
*Astronomy (Math. 6)	3	Thesis (C. E. 27)	5
**Bacteriology (Biol. 12)	5		
**Qualitative Analysis (Chem. 3)	4		
	19 or 21		19

*Required in the regular course only.

**Required in the sanitary engineering course only.

†Or 3 credits in architectual drafting.

Electrical Engineering

This course provides a thorough technical training in electrical engineering. The rapid development of electrical engineering is largely due to the use of sound theory in the solution of commercial problems. For this reason the theoretical subjects, and the application of theory to the solution of practical problems are emphasized.

The course is designed to teach students the scientific laws and principles forming the basis of the profession, and the application of these laws and principles to commercial problems. The general training consists of courses in mathematics, physics, chemistry, drawing and shop work. The electro-technical work consists of lectures and recitations on the theory of electrical phenomena, and on problems in the design, construction and operation of electrical machines and apparatus. Conventional methods are used in drawing and designing, and the experimental tests made in the laboratory are essentially similar to the tests made by large manufacturing companies. The apparatus and instruments used are of modern commercial types.

A limited number of electives is offered during the sophomore, junior and senior years. Students may choose their electives by consultation with the head of the department.

The course is supplemented by an annual inspection trip to some of the large power plants of Montana, and by lectures by prominent electrical engineers.

ELECTRICAL ENGINEERING.

FRESHMAN YEAR.

First Semester.		Second Semester.	
English Composition	(Eng. 1) 2	English Composition	(Eng. 1) 2
Algebra	(Math. 1) 3	Analytical Geometry	(Math. 3) 4
Trigonometry	(Math. 2) 2	Descriptive Geometry	(M. E. 3) 5
Public Speaking	(Eng. 4) 1	Public Speaking	(Eng. 4) 1
General Chemistry	(Chem. 1) 4	General Chemistry	(Chem. 1) 4
Elementay Drawing	(E. E. 21) 3	Foundry	(M. E. 30) 1
Woodwork	(M. E. 2) 2	Pattern Work	(M. E. 4a) 1
Foundry	(M. E. 4) 1	Military Drill	1
Military Drill	1		
	19		19

SOPHOMORE YEAR.

Expository Composition	(Eng. 2) 2	Calculus	(Math. 4) 5
Calculus	(Math. 4) 5	General Physics	(Phys. 1) 3
General Physics	(Phys. 1) 3	Physical Measurements	(Phys. 2) 2
Physical Measurements	(Phys. 2) 2	Electrical Machinery	(E. E. 1) 2
Forge Work	(M. E. 6) 2	Dynamo Drawing	(E. E. 2) 2
Military Drill	1	Military Drill	1
Elective	3 to 5	Elevtive	2 to 4
	18 to 20		17 to 19

JUNIOR YEAR.

Mechanics	(C. E. 5) 4	Mechanics	(C. E. 5) 4
Dynamos and Motors	(E. E. 3) 3	Applied Electricity	(E. E. 5) 4
Electricity and Mag.	(Phys. 5) 4	Dynamo Design	(E. E. 8) 3
Electrical Diagrams	(E. E. 7) 2	Strength of Materials	(M. E. 14) 1
Electrical Lab.	(E. E. 4) 2	Electrical Lab.	(E. E. 6) 2
Seminar	(E. E. 17) 1	Seminar	(E. E. 17) 1
Elective	2 or 3	Elective	2 to 4
	18 or 19		17 to 19

SENIOR YEAR.

Economics	(Econ. 3) 2	Economics	(Econ. 3) 2
Alternating Currents	(E. E. 9) 4	Alternating Currents	(E. E. 11) 4
Transformer Design	(E. E. 13) 3	Alternating Design	(E. E. 16) 3
Power Plant Practice	(M. E. 16) 1	Contracts and Specifications	(C. E. 14) 1
Electrical Lab.	(E. E 10) 3	Electrical Lab.	(E. E. 12) 2
Seminar	(E. E. 17) 1	Seminar	(E. E. 17) 1
Thesis	(E. E. 20) 2	Thesis	(E. E. 20) 3
Elevtive	2 or 3	Elective	2 or 3
	18 or 19		18 or 19

Mechanical Engineering

The purpose of the course in mechanical engineering is to fit its graduates for successfully filling responsible positions as supervising and designing engineers. It prepares for the design, construction and installation of machinery, steam and gas engines, shop, laboratory and power plant equipment, and for the design, superintendence and management of power plants and manufacturing establishments.

The course comprises four years' instruction and training by text book, lecture, laboratory and shop practice, based on mathematics, physics, chemistry, pure and applied mechanics, machine design, structural design and thermodynamics. It is designed to give the student a thorough knowledge of the basic principles of his profession and such technical skill as the application of theoretical principles in every day practice in shop and laboratory will insure. The work of each department—class room, laboratory, shop and designing room—is made to supplement the work of each of the others, thus giving a balance in the technical equipment of the young engineer obtainable in no other way.

MECHANICAL ENGINEERING.

FRESHMAN YEAR.

First Semester.		Second Semester.	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Algebra (Math. 1)	3	Analytical Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Descriptive Geometry (M. E. 3)	5
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
Public Speaking (Eng. 4)	1	Public Speaking (Eng. 4)	1
Mechanical Drawing (M. E. 1)	3	Pattern Work (M. E. 2a)	1
Foundry (M. E. 4)	1	Foundry (M. E. 30)	1
Military Drill	1	Military Drill	1
	19		19

SOPHOMORE YEAR.

Expository Composition (Eng. 2)	2	Calculus (Math. 4)	5
Calculus (Math. 4)	5	General Physics (Phys. 1)	3
General Physics (Phys. 1)	3	Physical Measurements (Phys. 2)	2
Physical Measurements (Phys. 2)	2	Electrical Machinery (E. E. 1)	2
Kinematics (M. E. 5)	5	Kinematics (M. E. 8)	5
Forge Work (M. E. 6)	2	Forge Work (M. E. 9)	1
Military Drill	1	Cement Tests (C. E. 15)	1
		Military Drill	1
	20		20

JUNIOR YEAR.

Mechanics (C. E. 5)	4	Mechanics (C. E. 5)	4
Steam Engineering (M. E. 7)	3	Thermodynamics (M. E. 18)	5
Electricity and Magnetism (Phys. 5)	4	Machine Design (M. E. 13)	6
Hydraulics (C. E. 8)	3	Strength of Materials (M. E. 14)	1
Mechanical Drawing (M. E. 10)	2	Mechanical Laboratory (M. E. 15a)	1
Machine Work (M. E. 17)	2	Machine Work (M. E. 21)	2
Power Plant Practice (M. E. 16)	1		
	19		19

SENIOR YEAR.

Economics (Econ. 3)	2	Economics (Econ. 3)	2
Steam Engineering (M. E. 22)	6	Power Plant Engineering (M. E. 29)	6
Steam Laboratory (M. E. 20)	2	Engineering Laboratory (M. E. 28)	2
Dynamos and Motors (E. E. 3)	3	Industrial Engineering (M. E. 25)	2
Electrical Laboratory (E. E. 6)	2	Seminar (M. E. 11)	1
Seminar (M. E. 11)	1	Elective	1 to 3
Machine Work (M. E. 27)	2	Thesis	4
Thesis	1		
	19		18 to 20

CIVIL ENGINEERING.

Professor Kneale.

Assistant Professor Snow.

The equipment of this department consists of transits, solar attachments, precision levels, hand levers, engineers' wye and dumpy levels, plane tables, alidades, declinators, tachymeters, theodolite, sextant and horizon, reflectoscope and lantern, aneroids, engineers' compass, current dumpy beters, weirs, tide gage, automatic water registers, model flumes, etc., odometer, vicat needle, Gilmore needles, bricquette machines and molds, weir measuring devices, specific gravity apparatus, fineness scales, polar and rolling planimeters, level and stadia rods, chains, tapes, drafting instruments, blue printing apparatus, complete photographic outfit, complete cement laboratory and drafting rooms well supplied with necessary equipment.

The department is quartered in eight rooms which include drafting rooms, seminar room, photographic dark room, cement laboratories, office, instrument room and lecture room.

(1) **Plane Surveying.**—The theory and practice of plane surveying, including the elementary principles, the use and adjustment of field and office instruments, the methods of field, topographic, hydrographic, mine and city surveying; barometric and spirit leveling, and the computation of earth work. Prerequisites, mathematics up to and including trigonometry. Texts, Theory and Practice of Surveying by Johnston, Manual of Surveying by Pence & Ketchum. Lectures, 3; laboratory, 2. I, 5. M. T. Th., 11 to 12; M. W. 1 to 3:30.

(2) **Elementary Drawing.**—This course is designed to teach the student the use of draughting instruments in topography, projection, isometric drawing, mapping, sketching and lettering; the principles of perspective; and tracing and blue printing. Owing to the demand for topographical draughtsmen the course has been extended through the second semester for all students desiring to become especially proficient, and is elective to all students completing the first semester's work. Laboratory, 3. I. T. Th., 8 to 10; F., 1 to 3.

(3) **Municipal Engineering.**—This course is designed especially to qualify the engineer along the lines of city planning, highway construction, both city and county. Method of allotting and plotting city additions, different surface materials, influence of grades, forms of gutters, culverts, curbing, etc., are carefully studied. This course is especially designed to meet the requirements of the municipal engineer. Prerequisites, C. E. I. 2 and 4. Baker's Roads and Pavements. Lectures, 3. II. M. T. Th., 8 to 9.

(4) **Railroad Engineering.**—Railroad reconnoisance, preliminary and location surveys. Theory and practice in laying out railroad structures, simple and compound curves, easements and transition spirals, simple and compensated grades, switches, turnouts and crossings. The making and use of mass diagrams, profiles, field maps, cross sections,

etc. Calculations of yardage in embankments, excavations and borrow pits. Complete map of location survey for short line of railroad. Prerequisite, C. E. 1. Texts, Searle's Field Engineering, Webb's Railroad Construction. Lectures, 4; laboratory, 2. II, 6. M. T. W. Th., 11 to 12; M. W., 1 to 3:30.

(5) **Mechanics.**—Forces and equivalence of force systems, center of gravity and centroids, attraction, stress, strain, principles of equilibrium, rectilinear and curvilinear motion, translation, work and energy, impulse, impact, momentum, second moments, vectors, materials of engineering and testing machines, elastic and ultimate deformation, theory of beams, columns and shafts, apparent and combined stresses, resilience, fatigue, least work, true internal stresses, riveting and friction. Texts, Maurer's Technical Mechanics, and Merriman's Mechanics of Materials. Lectures, 4. I and II. M. Tu. W. Th., 9 to 10.

(8) **Hydraulics.**—Theoretical hydraulics; hydraulic measurements; flow of water through orifices, over weirs, through pipes, conduits, and canals. Text, Merriman's Hydraulics. Prerequisites, mathematics to and including calculus, physics 1 and 2. Lectures, 3. M. T. W., 11 to 12.

(9) **Irrigation Engineering.**—This course includes a study of the principles of impounding, diverting, conveying and measuring water; a study of the structures required in irrigation systems such as flumes, siphons, head gates, weirs, diversion works, and the various types of dams; a study of the problems of seepage and drainage in their relation to irrigation and reclamation, a sufficient study of steam, gasoline and wind driven pumps, and pump types, to enable the student to select the most efficient device for raising water for service in irrigation. The problems of cost are also taken up. Prerequisites, C. E. I. and C. E. 4. Hydraulics must be taken in connection with the subject. Text, Irrigation Engineering, by Wilson. Lectures, 3. I. M. T. Th., 10 to 11.

(11) **Field Practice.**—Practice in the use of engineering instruments on the more difficult problems of civil engineering. The work is designed to develop speed and accuracy. The practical application of photography to surveys and to reports is given considerable attention. Prerequisites, C. E. 1 and 4; and Chem. 1. Laboratory, I. 4. 1 to 3:30. M. T. W. Th.

(12) **Seminar.**—In this course the student is required to deliver a lecture on an engineering topic; after the lecture the meeting is thrown open for general discussion. Each week a student is selected, by the professor in attendance, to preside at the meeting. The object of the course is to familiarize the student with recent engineering works, to assist in English composition and public speaking, and to point out the essential features of engineering articles. By means of the reflectoscope, which forms a part of the department's equipment, the student is enabled to give illustrated lectures. Lectures, 1. I and II, 2. F. 9 to 10.

(13) **Structural Engineering.**—Theory and practice in the analytic

and graphic calculation of stresses in simple structures. The structures studied will include the principal types of railroad and highway bridges; roof trusses, steel buildings; trestles; standpipes; reinforced concrete, etc. The laboratory periods are given to the preparation of complete working drawings and erection sheets for as many typical structures as possible. Prerequisites, C. E. 5 and 6. Text, Roofs and Bridges, part II, Merriman & Jacoby. Reference text, Theory of Modern Framed Structures, by Johnson, Bryan & Turneaure. Lectures, 2. Laboratory, 4. II, 6. 1 to 3:30 M. Tu. W. Th. 3:30 to 4:30 M. W.

(14) **Sanitary Engineering.**—Collection, purification and distribution of water; systems of water supply and sewerage; disposal of sewage; house drainage; sanitary inspection. Text, Folwell's Sewerage, and Turneaure & Russell's Water Supplies. Prerequisites, C. E. 4, 5, 6, 8 and 9. Lectures, 3, II. M. T. Th. F., 10 to 11.

(15) **Concrete and Cement.**—A study of the physical properties, processes of manufacture, and chemical composition of commercial cements. Standard commercial tests and interpretation of results. A study of the uses, proportions, metho . of mixing and placing of cement-mortar and concrete. Standard types of plain concrete structures. Text, Taylor's Practical Cement Testing. Laboratory, 2. II. 1 to 3:30 T. Th.

(17) **Geodetic Surveying.**—Elements of geodesy. Base line measurements, triangulation, determination of position by differences, etc. Regular senior study of C. E. course. Text, Breed & Hosmer's Higher Surveying. Lectures, 2. I. M. W., 9 to 10.

(18) **Water Power Develcpment.**—A course in the development of water power. The design and use of the turbine, impulse and other forms of water motors. The design and construction of headraces, spillways, etc. The class will be required, whenever possible, to examine water powers, and report upon the design and method of development. Considerable time will be devoted to the description of recently installed plants as published in the engineering journals. Text, Merriman's Hydraulics. Reference, Church's Hydraulic Motors. Prerequisites, C. E. 1, 5, 6, 8. Lectures, 3. I. M. W. F., 10 to 11.

(19) **Engineering Design.**—This course is devoted to the design of engineering works, maps, etc. Laboratory, 6. I, II. 1 to 3:30 T. Th. F.

(20) **Field Practice.**—This course is designed to give practice in the most advanced surveying. When the nature of the thesis is such as to require advanced surveying, or laboratory invstigation, this period may, at the discretion of the class officer, be used to assist in preparation of the thesis. Laboratory, 2. I. 1 to 3:30 T. Th.

(21) **Foundations and Masonry.**—This course includes a study of materials and methods employed in the construction of piers, abutments, masonry dams, and retaining walls; economy of construction, strength of joined materials; composition of different kinds of mortar; reinforced

concrete construction. Text, Baker's Foundations and Masonry. Lectures, 3. I. M. T. Th., 8 to 9.

(23) **Contracts and Specifications.**—The elementary law of contracts and its application to engineering considered, together with the correct form of specifications and the judicial interpretation placed on the technical terms commonly used in engineering specifications. Text, Johnson's Contracts and Specifications. Elective to all engineering students after the sophomore year. Lectures, 3. II. M. T. Th., 9 to 10.

(24) **Practical Astronomy.**—A short course in astronomy designed especially for the civil engineering students and to supplement the astronomy of mathematics. A considerable portion of the time in this course will be given to night work in taking observations. Text, Comstock's Field Astronomy for Beginners. Prerequisite, mathematics, 6. Laboratory, 2. II.

(25) **Cost of Construction.**—This course is designed to acquaint the student with the cost of labor and materials used in engineering construction; to point out the necessity and methods of keeping accurate records of the cost of proposed engineering surveys, and construction worw. Text, Gillette's Cost Data. Prerequisites, C. E. 1, 1a, 4, 5, 6, 8, 13 and 13a. Lectures, 2. I. 10 to 11 T. Th.

(27) **Thesis.**—The student will be required before graduation to present a suitable thesis upon some engineering subject in the line of his course. A copy of the same, together with all original maps, tables, etc., typewritten, bound, and upon specified paper, will be filed with the college and become its property. The student is required to select his subject at the beginning of the senior year. 5, II.

ELECTRICAL ENGINEERING.

Professor Thaler
Mr. Perrine

The electrical engineering department occupies a two story stone building, 36x52 feet. The first floor contains the dynamo laboratory, the machines for testing the strength of materials and two steam engines. The second floor contains a class and drafting room, an arc light room, a battery room, a photometer room, and an office. Steam and electrical power are obtained from the main power house.

The equipment of the electrical laboratory is very complete, with apparatus of modern type. There are two double current multipolar generators, capacity 15 K. W. These machines may be driven by the 40 H. P. engine or by the laboratory motor, and may be used as direct current dynamos, as alternators, single, two or three phase as synchronous motors or as rotary converters.

The two machines are also used for practice in synchronizing, and furnish alternating current for the induction motors, and for the mercury arc rectifier. For direct current work the laboratory contains in addition to the two generators, one Excelsior 15 light arc dynamo, connected

to eight series-arc-lamps, arranged for testing purposes, one 15 H. P. Northern Electric Co. motor, one 10 H. P. Siemens and Halske motor and one 16 H. P. Western Electric Co. bipolar motor. Each motor is provided with a friction brake and other auxiliary apparatus for complete tests of the armature and field resistances of the magnetic distribution and leakage, and of the efficiency and regulation at different loads; one 6 K. W. Excelsior dynamo may be used as either a shunt or a compound machine and is driven by the 10 H. P. motor and arranged for testing purposes.

For alternating current work the laboratory contains, in addition to the two generators, one mercury arc rectifier, capacity 30 amperes at 110 volts; one 2 H. P. single phase Westinghouse induction motor with phase splitter, provided with a prony friction brake for efficiency and regulation tests at different frequencies and at different voltages; one 6 H. P. three phase General Electric Co. induction motor, also provided with auxiliary apparatus for testing purposes.

A 150,000 volt testing transformer is used to test insulators for high tension transmission, and to test the insulation resistance of insulating materials.

There are six transformers, with capacities from 1 to 1½ K. W. and with different ratios. The transformers are arranged for testing the core losses, the copper losses, and the efficiency and regulation at various frequencies and voltages. They are also used for practice in transformer connecting for different purposes.

A General Electric Co. Oscillograph, with photometric and tracing table attachments, is provided for investigating the wave forms of alternating and oscillatory electro-motive forces and currents.

For general testing the laboratory contains one stationary lamp bank of 136 incandescent lamps, with a current capacity of 130 amperes at 110 volts; the lamps are arranged so that the current can be regulated within a small fraction of one ampere; four portable lamp banks of ten lamps each, arranged so that the lamps can be connected either in series or in parallel; one 900 Ohm iron wire resistance and five iron wire resistances for heavy currents, besides a number of rheostats, switches and current breakers.

The laboratory contains twenty-nine electrical measuring instruments, including nine voltmeters; one Whitney 150-300 volts; one Whitney 15 volts; one Weston 150 volts; one Weston milli-meter; one Weston 75-150 volt A. C.; one Westinghouse 150 volts switchboard voltmeter.

There are eight portable ammeters; one 5 ampere D. C. Weston, three Whitney ammeters, capacity 10, 25 and 50 amperes, D. C., respectively; two Hoyt's A. C. ammeters, 10 and 30 amperes respectively; one G. E. ammeter with series transformer, 120 amperes A. C.; and one Westinghouse, 120 amperes.

The department has four portable wattmeters; one Westinghouse, with series transformer, capacity 100 amperes at 200 volts; one Hoyt,

capacity 1,500 K. W.; one Weston, with multiplier, 2 amperes at 2,250 volts; one G. E. Co. wattmeter, capacity 10,000 watts.

There is one Leeds potentiometer with standard cell and standard resistances for calibrating instruments; one Kelvin standard balance for calibrating watt meters; one Weston portable galvonometer; one Jacobi testing set for measuring resistances; and four integrating watt meters, potential arc lamps of different types, arranged for testing.

The arc light room contains eight series-arc-lamps and five constant potential arc lamps of different types, arranged for testing.

In the photometer room is a Willyoung station photometer with universal rotator and bunsen screen for testing the candle power, distribution of light, and the efficiency of incandescent lamps.

The battery room contains a storage battery of 56 cells at 60 ampere hours capacity, of the following types: 10 chloride accumulators, 10 National Battery Co.'s unit accumulator, 10 Willard cells and 26 American cells. The batteries furnish current for calibrating instruments and are also available for testing purposes.

In the office is a 700-candle power Cooper-Hewitt mercury vapor lamp, apparatus for calibrating instruments, and wireless telegraph apparatus.

(1) **Electrical Machinery.**—Lectures on the construction, care and operation of commercial electrical machines and apparatus, including batteries, electric lights, dynamos, motors, alternators, transformers and electrical measuring instruments. Text book. Introduction to Electrical Engineering by H. H. Norris. Lectures, 2. II. T. Th. 10 to 11.

(2) **Dynamo Drawing.**—Detail working drawing, tracing, and blue printing of electrical machines in the laboratory, to familiarize the student with the conventional methods of representing the different parts of dynamos and motors. Laboratory, 2. II. F. 1 to 3:30; Sat. 8 to 10:30.

(3) **Dynamos and Motors.**—Principles of electro-magnetism, theory of dynamo electric machines, the design, construction and regulation of direct current dynamos and motors. Prerequisites, physics (1) and calculus. Textbook, Elements of Electrical Engineering, by Franklin and Esty. Lectures, 3. I. M. W. F., 10 to 11.

(4) **Electrical Laboratory.**—Laboratory tests to determine armature and field resistance, magnetic leakage coefficients, characteristic curves and the efficiency and regulation of various types of direct current machines. Prerequisites, physics (2) and (6). Textbook, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Labaratory, 2. I. M. T., 1 to 3:30.

(5) **Applied Electricity.**—Methods and calculations of wiring, theory of primary cells and storage batteries, electric light and electrical measuring instruments. Prerequisites, calculus and physics (1). Textbook, Elements of Electrical Engineering, by Franklin & Esty. Lectures, 4. II. M. T. W. Th. 10 to 11.

(6) **Electrical Laboratory.**—Tracing circuits and wiring, calibrating instruments, efficiency tests of storage batteries, and the candle power of incandescent lamps. Prerequisites, physics (2). Textbook, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. II. M. T. 1 to 3:30.

(7) **Electrical Diagrams.**—Conventional methods of representing electrical wiring and appliances. Drawings and wiring diagrams of the switchboards in the laboratory and in the power house and diagrams of the wiring of the college buildings. Laboratory, 2. I. T. Th., 10 to 12.

(8) **Dynamo Design.**—Problems in designing electro-magnets, dynamos and motors. Complete working drawings and specifications to accompany each design. Prerequisite, dynamo drawing. Reference, Design of Dynamos, by S. P. Thompson. Laboratory, 3. II. W. Th. 1 to 3:30; Sat. 8 to 10:30.

(9) **Alternating Currents.**—Theory of Alternating currents, properties of alternating current circuits, principles of alternators, transformers, rotary converters and induction motors, methods of testing alternating current apparatus. Prerequisites, physics (5). Textbook, Alternating Current Machines, by Sheldon, Mason & Hausmann. Lectures 4. I. M. T. W. Th. 10 to 11.

(10) **Electrical Laboratory.**—Laboratory tests of single phase alternating current generators, motors and transformers, calibration of alternating current measuring instruments and meters. Prerequisites, physics (6). Textbook, Laboratory and Factory Tests in Electrical Engineering by Sever & Townsend. Laboratory, 3. I. W. Th. F. 1 to 3:30.

(11) **Alternating Currents.**—Development of the symbolic method of Steinmetz, the solution of problems in transformer design and calculation of transmission line by the use of the algebra of complex numbers and by vector diagrams. Prerequisites, alternating currents (9). Textbook, Alternating Current Phenomena, by Steinmetz. Lectures, 4. II. M. W., 10 to 11. T. Th., 11 to 12.

(12) **Electrical Laboratory.**—Laboratory tests of polyphase alternating current apparatus, including generators, motors, transformers and converters. Efficiency and regulation tests of a mercury arc rectifier, connecting transformers for transforming from three phase to two phase. Prerequisite, alternating current testing. Textbook, Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. II. Th. F., 1 to 3:30.

(13) **Transformer Design.**—Design and drawing of transformers to conform with certain specifications of efficiency and regulation. Calculation of the cost of the transformer. Open to students taking E. E. 9 and 11. Laboratory, 3. I. M. T. Th. 8 to 10.

(14) **Contracts and Specifications.**—The law of contracts and its application to engineering contracts. Students are required to make specifications for estimates on proposed power plants, transmission lines or electrical apparatus. Textbook, Contracts and Specifications, by John-

son, and Electrical Lighting Specifications, by Merrill. Lectures, 1. II. F. 10 to 11.

(16) **Alternator Design.**—Problems in designing alternators, converters and induction motors. Design and specifications of alternating current circuits. Prerequisites, alternating currents (9). Laboratory, 3. II. M. T. W. 8 to 10.

(17) **Seminar.**—Weekly meeting for the purpose of discussing current electrical engineering literature. Lectures, 1. I and II, 4. F. 9 to 10.

(18) **Special Design.**—Design and construction of some special electrical apparatus or machine. Elective for seniors. Laboratory, 3. I or II.

(20) **Thesis.**—Before graduating each student must present a suitable thesis upon some engineering subject in line with his course. One copy of the thesis will be filed in the college library as the property of the college. The subject for the thesis must be chosen at the beginning of the senior year. 5. I and II.

(21) **Elementary Drawing.**—Plain lettering, the use of instruments, geometrical problems, orthographic, isometric, and cabinet projections of simple objects. Laboratory, 3. I. T. Th. S., 8 to 10.

MECHANICAL ENGINEERING.

Professor Dearborn,
Assistant Professor Marshall.
Mr. Challender,
Mr. Kateley,
Mr. Park.

The facilities provided for the instruction and practice in the department of mechanical engineering include class rooms, drawing room and office occupying the south half of the basement of College Hall, wood shop, forge shop, iron and brass foundry, machine shop, office and reading room in the shop building, steam and material testing laboratory in the engineering laboratory, and the power plant of the college.

The drawing room is furnished with desks and drawers for one hundred and twenty-four students, and with numerous models, machine parts, and blue prints of trade machinery. The equipment includes also demonstration apparatus, blue print facilities, beam compasses, protractors, odontograph and universal drafting machine. The work in drawing and design is carried on in such a way as to bring out its relation to the subsequent work in the shops, sound commercial practice being emphasized.

The material testing laboratory equipment includes a Riehle 100,000 pound testing machine, both automatic and autographic, with extensiometer for tension and compression tests, and deflectometer for transverse tests; an Olsen torsion machine for specimens having a cross section up to one and one-fourth inches square; also micrometers, surface

plate and gage with micrometer indicator for testing parallelism, calipers, scales, etc.

The equipment available for steam and gas engine tests comprises in part the following: A 7x7 in. vertical steam engine with eccentric adjustable; an 8x12 in. automatic cut-off Woodbury engine, with water cooled brake wheel, connected up with a 50 H. P. Dean Bros. surface condenser and arranged to run condensing or non-condensing, and with or without live or exhaust steam in the cylinder jacket; an 11x12 in. automatic cut-off Lycoming engine direct-connected to a 40 K. W. direct current generator, furnishing light and power for the college; two small gasoline engines; all necessary brakes, generators and lamp banks for loading the engines; scales, meters, tanks, etc. In addition there are planimeters, separating and throttling calorimeters, thermometers, one Tabor (outside spring) indicator, one Thompson indicator, one set Crosby indicators, with electro-magnetic device for taking simultaneous cards, standard pressure gages, apparatus for testing gages and indicator springs under steam pressure and a Crosby oil pressure gage testing outfit.

A one hundred twenty-five horse-power Root water tube boiler, a one hundred twenty-seven horse-power Stirling water-tube boiler, an Advance compound traction engine, together with pumps, ejectors, feed water heaters, fans, etc., and the station heating plant, furnish extensive facilities for the investigation of problems related to power production, heating and ventilation.

The shops are equipped with standard machinery, and tools for working wood and metal. This equipment is being added to as needed, largely by manufacture in the shops by the students, under the supervision of competent foremen.

The wood shop measures 36x50 feet and is furnished with modern wood-working machinery, including a 20 inch Fay planer, a 14 inch circular pattern saw, a 36 inch band saw, a Fay universal jointer, a Fay and Egan friezer, a jig saw, foot mortiser, trimmer, a 16 inch pattern lathe, seven 10 inch lathes with turning-tools for thirty-six students, and seventy-two complete sets of carpenter tools, with benches for joinery, house carpentry, pattern work and cabinet work.

The forge shop is 28x60 feet and contains nineteen down draft power forges with Sturtevant blowers, a 50lb. power hammer, shear, grinder, and a full equipment of anvils and small tools. In the work here a graded series of exercises leads the student from simple drawing and upsetting to size, to complex forging and tool making, hardening and tempering, all the work being done from working drawings.

The foundry, 30x48 feet, is equipped with a No. 1 Whiting cupola having a melting capacity of one ton of iron per hour, a brass furnace, core oven, crucibles, flasks and patterns. The work comprises bench and floor moulding, cupola and brass furnace practice, the product consisting of castings of machine parts, test bars, brass, bronze and other alloys for bearing metal, ornamental pieces, etc.

The machine shop measures 60x72 feet, and adjoining it are the tool room, stock room, office, lavatory and locker room. The equipment includes an 18 inch Davis and Egan, a 16 inch LeBlond and three 16 inch Flather engine lathes, a 22 inch Flather planer, a 16 inch Davis and Egan shaper, a Gisholt tool grinder, a 28 inch Cincinnati drill, a 20 inch Prentice drill, a 14 inch sensitive drill, a 24 inch Barnes grinder, a 6 inch pipe machine, speed lathe, power hack saw, etc., and in the tool room a No. 1 Cincinnati universal milling machine, a Cincinnati universal grinder, a Yankee drill grinder, a brazing and tempering outfit, besides a complete equipment of small tools.

(1) **Mechanical Drawing.**—The use of drawing instruments and plain lettering; problems in geometric construction to teach accuracy in the use of instruments; orthographic projection; dimensions, arrangement, titles; tracing and blue-printing. Laboratory, 3. I. F. 8 to 10, Tu. Th. 1 to 3:30 F.

(2) **Wood-work.**—A graded set of problems is given with instruction in the proper use and care of carpenter's tools and practice in working to dimensions from blue-prints, followed by a graded series of exercises in wood turning and pattern making. Laboratory 2. I. Fr. T. Th. 1 to 3:30.

(2a) **Pattern Work.**—A continuation of (2) in the construction of wood patterns for use in the foundry. Laboratory, 1. II. Th. Fr., 1 to 3:30.

(3) **Descriptive Geometry.**—Projections of lines, plane surfaces and solids; intersections, tangents to curves and surfaces; problems in warped surfaces; practical appliances. Text, Phillips & Millar. Lectures, 2. Laboratory, 3. II. 5. T. F. 9 to 10, W. 10 to 11, Th. 8 to 10, F. 1 to 3:30.

(4) **Foundry**—The instruction includes practice in floor and bench molding, core making, and in pouring castings of iron, brass and other alloys. Laboratory, 1. I. M., 1 to 3:30.

(5) **Kinematics.**—A study of the relative motions of machine parts, including rolling cylinders and cones, lobed wheels, belts, levers, cams, linkwork, parallel and straight line motions, intermittent linkwork, wheels in train, and aggregate combinations. Text, Schwamb and Merrill, Elements of Mechanism. Lectures, 3. Laboratory, 2. I. 5. M. W. F. 10 to 11, M. W. 1 to 3:30.

(6) **Forge Work.**—A graded set of exercises in iron forging, designed to teach the operations of drawing, upsetting, forming and welding, followed by exercises in forging, hardening and tempering tool steel. Laboratory, 2. I. F. 1 to 3:30, Sat. 8 to 10:30.

(7) **Steam Engineering.**—A study of steam boilers, their classification and construction, their settings, furnaces and chimneys, and of the construction and use of the various accessories and appliances found in the boiler room; a careful study of combustion and furnace efficiency, and of the principles underlying the economical transfer of heat from the furnace to the water. Scale, corrosion and feed-water treatment are

given considerable attention. The course must be preceded or accompanied by (16). Prerequisite, Chemistry (1), and Physics (1) and (2). Lectures, 3. I. M. W. F., 11 to 12.

(8) **Kinematics.**—A continuation of (5) in the study of gearing; the cycloidal and involute systems, spur, bevel and screw gears, and the construction of the tooth. The analysis of valve motions and the design of valve gear by the use of the Zeuner and Bilgram diagrams. Texts, Schwamb and Merrill, and Spangler, Valve Gears. Lectures, 3. Laboratory, 2. II. 5. Soph.

(9) **Forge Work.**—A continuation of the work in steel forging, including tempering, annealing and case-hardening. Laboratory, 1. II. Soph. F., 1 to 3:30; S., 8 to 10.

(10) **Mechanical Drawing.**—The making of working detail and assembly drawings of machinery from measurement and empirical design; the construction and interpretation of graphical charts involving engineering principles and data, and the graphical solution of problems involving stresses in cranes, structural members and machine parts. Prerequisite, Kinematics (8), taken with Mechanics (5). Laboratory, 2. I. T. Th., 10 to 12; F. 8 to 10.

(11) **Seminar.**—Weekly meetings for the presentation and discussion of papers upon assigned topics pertaining to mechanical engineering. Lecture, 1. I and II. Sr.

(13) **Machine Design.**—A study of machines with regard to material, form and strength of parts, and methods of construction. The development of rational and empirical formulae, and a study of experimental data, with application in a parallel course in drawing. Materials are studied in detail, particularly cast iron, wrought iron and steel, the brasses and bronzes, the alloy steels and high speed steel, as well as the effect of heat treatment on the carbon and structure of steel. Text, Kimball and Barr, Machine Design, and Smith, Materials of Machines. Prerequisite, Mechanical Drawing (10). Lectures, 3. Laboratory, 3. II. 6. M. T. Th. 11 to 12, T. W. Th. 1 to 3:30.

(14) **Strength of Materials.**—The work consists of experimental determinations of the strength and various moduli of the more important of the materials of engineering. Tests are made in compression, tension, cross-bending and torsion, upon which written reports and discussions are required, involving a discriminating comparison of results with accepted experimental data. Taken with Mechanics (6). Laboratory, 1. II. F. 1 to 3:30.

(15a) **Mechanical Laboratory.**—The use and testing for error of micrometers, planimeters and slide rules. The calibration of pressure gages, indicator springs, scales and tachometers, and efficiency tests of jack screws and hoists. Reference, Carpenter, Experimental Engineering. Prerequisite, Mechanics (5). Laboratory, 1. II. M. 1 to 3:30.

(16) **Power Plant Practice.**—Each student spends 2½ hours per week as assistant in the college power plant, obtaining practical experience under a first-class engineer in handling boilers, pumps, engines,

heating apparatus and electrical machinery, including dynamos, motors, and switch board. Laboratory, 1. I.

(17) **Machine Work.**—Instruction and practice in chipping, filing, laying out, fitting, scraping, soldering and brazing. Laboratory, 2. I. T. Th. 1 to 3:30.

(18) **Thermodynamics.**—A study of the principles of thermodynamics; a discussion of the properties of gases, saturated and superheated vapors, especially of air and steam; and a study of the various cycles of steam engines, hot air engines and internal combustion engines from the physical, analytical and graphical point of view. Text, Peabody, Thermodynamics of the Steam Engine, and Berry, Temperature-Entropy Diagram. Prerequisite, M. E. 7, 8, 16. Lectures, 5. II. M. T. W. Th. F. 10 to 11.

(20) **Steam Laboratory.**—Steam and gas engine indicator practice, valve setting by measurement and by the card, calorimetric determination of the quality of steam, tests of pumps, injectors, and engines. Prerequisite, Thermodynamics (18). Laboratory, 2. I.

(21) **Machine Work.**—Practice with instruction in drilling, boring, turning, thread and gear cutting. Prerequisite, (12). Laboratory, 2. II.

(22) **Steam Engineering.**—The application of the principles of thermodynamics in the study of the compound engine, Hirn's analysis, economy of engines, compressed air, the flow of fluids through orifices, nozzles and pipes, the steam injector, the steam turbine in detail, refrigerating and heating systems, air, steam and hydraulic pumps. The work in design will cover the details of one or more pieces of apparatus studied in class. Text, Peabody, Kent; Reference, Thomas. Prerequisite, Thermodynamics (18). Lectures, 4. Laboratory, 2. I. 6.

(25) **Industrial Engineering.**—The organization and management of manufacturing establishments; cost accounting, distribution of expenses; systems of compensating labor; contracts and specifications. Lectures, 2. II.

(27) **Machine Work.**—Advanced work on lathe, milling machine, and grinder. The manufacture of reamers, drills, taps, mills, and dies. The heat treatment of high speed steel. Laboratory, 2. I.

(28) **Engineering Laboratory.**—A continuation of (20), including efficiency tests of heating, ventilating, and power plant equippment. Laboratory, 2. II.

(29) **Power Plant Engineering.**—The study and design of a modern steam power plant. The work includes the design of the structural features of the building or buildings of the plant, together with the selection, from standard types, of such apparatus as will be best suited to the requirements laid down, and the assembling of these engines, boilers, fans, and auxiliaries in such a way as will give the highest possible operating economy. Prerequisite, M. E. (14), (18), and (22). Lectures, 4. Laboratory, 2. II. 6.

(30) **Foundry.**—Cupola and brass furnace practice, together with the study of the manufacture and properties of iron and steel, the

brasses and bronzes and related alloys. Lectures and Laboratory, 1. II. T. 1 to 3:30.

Thesis.—Before graduating, the student is required to present an acceptable thesis involving an investigation of some problem related to mechanical engineering, which will become the property of the college The work will done under the supervision of the head of the department but the student will devise his own methods. The subject must be selected by November fifteenth of the senior year. I and II. 5.

Division of Science

DIVISION OF SCIENCE.

The college offers six separate courses leading to the degree of bachelor of science, which are tabulated on the following pages. It will be noted that in these tabulations there is but little change in the actual requirements from the work offered during past years. In the earlier years of the course, much of the foundation work in science, language and mathematics is common to all the courses.

The names given to these courses are generally indicative of their nature—Biology, Chemistry, Home Science, History-Literature, Mathematics-Physics and Secretarial.

Candidates for the bachelor's degree in science must complete satisfactorily not less than 130 credits, including the prescribed work in military drill or physical training; and including also a thesis, the value of which in credits shall be determined by the instructor concerned. No regular student may take in any one semester work amounting to more than nineteen credits or less than twelve.

Students who are relieved for any reason of the requirements in military drill or physical training, shall present four additional credits in some other subject; but the president may, at his discretion, excuse from such requirements any student in the employ of the institution.

Several subjects taught in departments not represented in this division are open to election by students in science on consent of their advisers. Among these may be mentioned music, (limited to four credits for any one person) and such subjects in the divisions of agriculture or engineering as the applicants may be qualified for, and as the schedule permits.

In the case of music elected by regular students, the college will furnish without charge a maximum of four credits to be taken in the junior or senior year, at the rate of not more than one lesson per week; and this is allowed in either the department of voice, or piano.

A more detailed statement of the direct purpose of these courses may be found just preceding the tabulation of each course.

Biology

Through the electives allowed in the biology course the student may select lines leading toward the following professions: General zoology, general botany, economic entomology, plant pathology, and bacteriology. The course also furnishes an excellent preliminary training for the professions of medicine, veterinary science, forestry, and teaching. In the government service, both in the Department of Agriculture at Washington and in the various experiment stations, there are many desirable openings both for young men and young women. In plant pathology, bacteriology, and entomology there is a growing demand for suitably qualified workers. Women are more and more in demand as scientific clerks and assistants. The passage of the Adams act whereby the federal appropriation to the experiment stations in the various states is materially increased, is creating a greater demand for workers in biological as in other lines, and as never before the outlook in these lines is inviting.

Students in the biology course are allowed some latitude in the election of their science work but it is intended that they shall be guided by the class officer in selecting the sub-courses that contribute most directly to their chosen line of work.

In the elective work in the junior and senior years women are allowed wide privileges.

For graduation from the course in biology, one year of Latin and a reading knowledge of French and German are required. More of each is desirable, but as soon as these amounts are accomplished, the student may elect other subjects in place of foreign language.

BIOLOGY

FRESHMAN YEAR

First Semester		Second Semester	
Eng. Comp. (Eng. 1)	2	Eng. Comp. (Eng. 1)	2
Foreign Language	4	Foreign Language	4
Gen. Botany (Biol. 9)	5	Plant Physiology (Biol 10)	4
Gen. Chemistry (Chem. 1)	4	Gen. Chemistry (Chem. 1)	4
Draw. from Nature (Art. 4)	2	*Prin. of Plant Cult. (Hort. 1)	4
Drill	1	Drill	1
	18		19

SOPHOMORE YEAR

Expository Comp. (Eng. 2)	2	Expository Comp. (Eng. 2)	2
Foreign Language	3 or 4	Foreign Language	3 or 4
Invertebrate Zool. (Biol. 1)	4	Animal Physiology (Biol. 3)	5
Algebra and Trig. (Math. 1 & 2)	5	Geology (Geol. 1)	3
Photography (Chem. 14)	2	Organic Chemistry (Chem. 5)	5
Drill	1	Drill	1
	17 or 18		19 or 20

JUNIOR YEAR

Eng. Literature (Eng. 10)	2	English Literature (Eng. 10)	2
Foreign Language	3 or 4	Foreign Language	3 or 4
Gen. Des. Physics (Phys. 1a)	3	Gen. Des. Physics (Phys. 1a)	3
General Entomology (Biol. 4)	4	Organic Evolution (Biol. 14)	2
Bacteriology (Biol. 12)	5	Elect two of the following	
		Vertebrate Zool. (Biol. 2)	4
		Adv. Entomology (Biol. 6)	4
		Plant Pathology (Biol. 11)	4
	17 or 18		18 or 19

SENIOR YEAR

Eng. Comp. or Lit. (Eng. 3, 11, or 13)	2	Eng. Comp. or Lit. (Eng. 3, 11, or 13)	2
Economics (Econ. 3)	2	Economics (Econ. 3)	2
Psychology (Phil. 1)	3	Ethics (Ethics 2)	3
Thesis	5	Thesis	5
Elective	4-7	Elective	4-7
	16—19		16—19

*Women may, if desired, elect other subjects in place of Principles of Plant Culture.

Chemistry

The principles of chemistry, together with some of the applications of the science, are taught to the freshmen in all courses offered by the college. In addition to this elementary instruction some departments require sufficient training in chemistry to enable the student to apply the principles of the science to some special phase of the general course he is pursuing. This is true in the college courses in agriculture, domestic science and sanitary engineering. Further, students who wish to follow chemistry as a profession are advised to take systematic training in the science during the four years of undergraduate study.

The outline of studies offered in the chemical course is designed to meet the needs of the last named class of students. It is believed such a course should provide a liberal education along with as much technical skill as it is possible to obtain. With this end in view and with the idea that the technical training should have some definite aim, two options are offered. One option gives a training in the various branches of chemistry together with several fundamental courses in biology and agriculture, the other option combines a number of carefully selected engineering studies with chemistry.

The agricultural option gives an excellent foundation for the future study of almost any phase of agricultural science. Especially it leads to agricultural chemistry as applied in experiment station laboratories. The engineering option offers a combination of studies which approaches what is usually known as a course in chemical engineering. It prepares for positions in chemical laboratories connected with manufacturing industries and for conducting operations requiring a working knowledge of both chemistry and engineering.

In the following schedule of studies, those subjects marked with one sign (†) are required only of those who elect the agricultural option. The studies required in the engineering option are marked with two signs (††), while the unmarked subjects are required of all students who take the chemical course. The freshman and sophomore years are the same for both options.

CHEMISTRY

Options † Agricultural Chemistry.
‡‡ Chemical Engineering.

FRESHMAN YEAR.

First Semester		Second Semester	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Algebra (Math. 1)	3	Analytical Geometry and Calculus (Math. 3)	4
Trigometry (Math. 2)	2	General Chemistry (Chem. 1)	4
General Chemistry (Chem. 1)	4	Descriptive Geometry (M. E. 3)	4
German or French	4	German or French	4
Mechanical Drawing (M. E. 1)	3	Drill	1
Drill	1		
	19		19

SOPHOMORE YEAR.

Qualitative Analysis (Chem. 2)	4	Organic Chemistry (Chem. 5)	5
Anal. Geom. and Cal. (Math.4)	5	Anal. Geom. and Cal. (Math.4)	5
General Physics (Phys. 1)	3	General Physics (Phys. 1)	3
Physical Meas. (Phys. 2)	2	Physical Meas. (Phys. 2)	2
German or French	3 or 4	German or French	3 or 4
Drill	1	Drill	1
	18 or 19		19 or 20

JUNIOR YEAR.

Mineralogy (Chem. 12)	4	Geology (Geol. 1)	3
†Invertebrate Zoology (Biol. 1)	4	Light and Sound (Phys. 3)	2
†Soil Physics (Agron. 2)	5	Phys. Meas. (Phys. 4)	2
†Agri. Chem. (Chem. 7)	4	Quant. Anal. (Chem. 3)	4
‡‡Engineering Chem. (Chem.9)	5	†Animal Physiology (Biol. 3)	5
‡‡Electricity and Mag. (Phys. 5)	4	†Soil Fertility (Agron. 3)	3
‡‡Foundry (M. E. 4)	1	‡‡Foundry (M. E. 30)	1
‡‡Kinematics (M. E. 5)	5	‡‡Forge (M. E. 6)	2
		‡‡Electrical Machinery (E. E. 1)	2
	17 or 19		16 or 19

SENIOR YEAR.

Economics (Econ. 3)	2	Economics (Econ. 3)	2
Adv. Inorganic Chemistry (Chem. 6)	3	Adv. Inorganic Chemistry (Chem. 6)	3
Thesis (Chem. 16)	2	Thesis (Chem. 16)	2
Quantitative Analysis (Chem.3)	4	†Organic Analysis (Chem. 4)	4
†General Botany (Biol. 9)	5	†Plant Physiology (Biol. 10)	4
†Elective	3	†Elective	4
‡‡Dynamos and Motors (E. E. 3)	4	‡‡Assaying (Chem. 13)	4
‡‡Electrical Laboratory (E. E. 4)	2	‡‡Applied Electricity (E. E. 5)	4
‡‡Elective	2	‡‡Elective	4
	19		19

History and Literature

In accordance with the general plan of the divison of science, this course leads to the degree of bachelor of science. It includes properly, therefore, strong courses in at least two of the three sciences, physics, chemistry and biology, though it does not contemplate advanced work in any of these subjects. Throughout the course a large amount of time is devoted to the study of foreign language and during the later years of the course a good deal of time is given to history and literature. It is not expected that the graduate in this course will be technically equipped in any of these subjects, though by the systematic arrangement of his electives he may emphasize such lines of the work as he is especially attracted to. Graduates should therefore be fitted to teach in the high schools, history, English, and one or more of the foreign languages.

The prime purpose of the course, however, is to offer to those who can afford it a good general education, the purpose of which shall be a wide acquaintance and sympathy with the most important ideas and activities of civilization. Such an education, it is believed, is well worth having for its own sake; and for those who can afford the time, it is a valuable preparation for the specialization of the graduate school, or of the professional or technical school.

HISTORY AND LITERATURE.

FRESHMAN YEAR.

First Semester		Second Semester	
English Comp. (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (Eng. 4)	1	Public Speaking (Eng. 4)	1
Algebra (Math. 1)	3	Anal. Geometry (Math. 3)	4
Trigonometry (Math. 2)	2	Foreign Language (Fr., Gr., or Latin)	4
Foreign Language (Fr., Ger., or Latin)	4	General Chemistry (Chem. 1)	4
General Chemistry (Chem. 1)	4	Art	2
Military Drill	1	Military Drill	1
or Sewing (H. S. 11)	3		
	17 or 19		18

SOPHOMORE YEAR.

English Composition (Eng. 2)	2	English Composition (Eng. 2)	2
English Literature (Eng. 10)	2	English Literature (Eng. 10)	2
Foreign Language	6 or 8	Foreign Language	6 or 8
Euopean History (Hist. 1)	3	European History (Hist. 1)	3
Military Drill	1	Military Drill	1
*Elective	2-5	*Elective	2-5
	15-19		15-19

JUNIOR YEAR.

**Economics (Econ. 3)	2	Economics (Econ. 3)	2
Foreign Language	2-4	Foreign Language	2-4
English Literature or Composition (English 3, 11 or 13)		English Literature or Composition (English 3, 11, 12 or 13	
or History (2 or 5)	2-3	or (History 2 or 5)	2-4
*Elective	9-12	*Elective	6-11
	15-19		15-19

SENIOR YEAR.

Psychology (Psych. 3)	3	Ethics (Ethics 2)	3
Sociology (Philosophy 4)	3	Thesis (3)	6
Elective	9-13	Elevtive	6-10
At least 4 credits must be taken in either History, English or Foreign Language.		At least 4 credits must be taken in either History, English or Foreign Language.	
	15-19		15-19

*All candidates for a degree in this course must take a year of work either in physics or biology. All young ladies are also advised to take one course in cooking.

**The order in which the required subjects are to be taken up in the junior and senior years may be varied upon the consent of the class officer and the instructor concerned.

Home Science

The object of this course is two-fold: First, to give young women a liberal education with a scientific basis and to train them along lines pertaining to the science, management and care of the home. Second, to give training to those who wish to become teachers of home science. This course gives an opportunity for the combination of biology and chemistry with home science.

In the junior and senior years there is considerable opportunity for electives, but electives must be chosen by the advice and with the approval of the class officer. History, German, French, art, music and English may be elected in the junior year. History, chemistry, biology, art, music and English may be elected in the senior year.

HOME SCIENCE.

FRESHMAN YEAR.

First Semester		Second Semester	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (Eng. 4)	1	Public Speaking (Eng. 4)	1
German or French	4	German or French	4
Trig. and Log. (Math. 2a)	3	Applied Algebra (Math. 7)	2
General Chemistry (Chem. 1)	4	Prin. of Cookery (H. S. 1)	4
Sewing (H. S. 11)	3	General Chemistry (Chem. 1)	4
Art (Art 1)	2	Art (Art 1)	2
	19		19

SOPHOMORE YEAR.

Expository Composition (Eng. 2)	2	Expository Composition (Eng. 2)	2
German or French	2 or 4	German or French	2 or 4
Food Chemistry (Chem. 8)	5	Food Studies (H. S. 2)	4
Invertebrate Zoology (Biol. 1)	4	Animal Phys. & Anat. (Biol. 3)	5
Dressmaking (H. S. 12)	2	Art	1
Art	1		
	16 or18		16 or18

JUNIOR YEAR.

Economics (Econ. 3)	2	Economics (Econ. 3)	2
Bacteriology (Biol. 12)	5	Invalid Cookery (H. S. 5)	2
Advanced Cooking (H. S. 4)	2	Topical Course (H. S. 7)	2
Dietetics (H. S. 6)	2	Advanced Dressmaking (H. S. 14)	3
Textiles (H. S. 13)	2	European History (Hist. 1)	3
European History (Hist. 1)	3	or Organic Chemistry	
or Qualitative Analysis		(Chem. 7 or 11)	5 or 2
(Chem. 2)	4	Elective	2 to 4
	16 or 17		18 to 19

SENIOR YEAR.

Psychology (Phil. 1)	3	Ethics (Phil. 2)	3
Teacher's Course (H. S. 8)	3	Teacher's Course (H. S. 8)	2
Teaching of Domestic Art		Embroidery (H. S. 16)	2
(H. S. 15)	3	Thesis	2 to 4
Thesis	2 to 4	Elective	4 to 6
Elective	3 to 5		
	15 to 18		15-17

Mathematics and Physics

This course as outlined on the opposite page is designed to fill the needs of two or three classes of students. The required work is such as to give an excellent preparation for students desiring to become teachers in these subjects, and by proper choice of the electives a broad education in other subjects may be obtained. Prospective teachers are advised to arrange their electives so that they will be qualified to teach other subjects, such as biology, chemistry, English or foreign language, as often they are required to teach such subjects in combination with mathematics or physics.

There is an increasing demand for men who have a more extended and exact knowledge of the fundamental sciences than can be obtained from the ordinary technical course. This all comes from a class of employers who desire men so equipped and prefer to give them the practical training they need. The course is designed to give the theoretical training. If the student should take this course, planning to take an engineering course later, he can choose his electives so that any of the engineering courses may be completed in two years after graduation from the mathematics-physics course. In this case the following subjects are suggested from which it is desirable to elect: Freehand drawing, mechanical drawing, chemistry, mechanics, applied electricity, dynamos and motors, hydraulics, sanitary engineering. The particular electives of this course will be chosen in accordance with the direct aim of the student. In addition, the above course lays a foundation for the work of the graduate school.

MATHEMATICS-PHYSICS.

FRESHMAN YEAR.

First Semester		Second Semester	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (Eng. 4)	1	Public Speaking (Eng. 4)	1
Algebra (Math. 1)	3	Anal. Geometry and Calculus (Math. 3)	4
Trigonometry (Math. 2)	2	German or French	4
German or French	4	General Chemistry (Chem. 1)	4
General Chemistry (Chem. 1)	4	Military Drill	1
Military Drill	1		
	17		16

SOPHOMORE YEAR.

Expository Composition (Eng.2) or English Literature (Eng. 10)	2	Expository Composition (Eng.2) or English Literature (Eng. 10)	2
Analytical Geometry and Calculus (Math. 4)	5	Analytical Geometry and Calculus (Math. 4)	5
General Physics (Phys. 1)	3	General Physics (Phys. 1)	3
Physical Measurements (Phys. 2)	2	Physical Measurements (Phys. 2)	2
German or French	3 or 4	German or French	3 or 4
Elective	0 to 4	Elective	0 to 4
Drill	1	Drill	1
	17-20		17-20

JUNIOR YEAR.

Differential Equations (Math. 10)	3	Geology (Geol. 1)	3
Electricity and Magnetism (Phys. 5)	4	Differential Equations(Math. 10)	3
or Least Squares (Math. 5)	2	Light and Sound (Phys. 3)	2
Economics (Phil. 3)	2	Physical Measurements (Phys.4)	2
Elective	6 to 10	Economics (Phil. 3)	2
		Elective	6 to 8
	17-19		17-19

SENIOR YEAR.

Theoretical Astronomy (Math. 6)	3	Theoretical Astronomy (Math. 6)	3
Two Courses from Advanced Physics (Phys. 6)	3	Two Courses from Advanced Physics (Phys. 6)	3
and Mathematics (11, 12, 13 or 14)	2 or 3	and Mathematics (11, 12, 13 or 14)	2 or 3
Elective and Thesis	7 to 11	Elective and Thesis	7 to 11
	17-19		17-19

Secretarial Course

The college this year offers a secretarial course of four years leading to a degree, probably B. S. This course is not yet fully formulated, but the freshman year will correspond to that of the history-literature course on page 65, except that typewriting and stenography will be substituted for the chemistry. The general plan of the course will include with the work in stenography and typewriting a large amont of work in English composition and literature, history, economics, the modern foreign languages, with one course in laboratory science, and some work in business, law, accounting, business correspondence, bibliography and the preparing of copy for the press; and for the young women, some work in domestic science. The purpose of the course is to prepare expert office assistants of a grade demanded by many professional and business men and business corporations. Such a course is now offered in several colleges. It is intended to afford to the young women an introduction to an industrial career corresponding to the opportunities afforded to the young men. It will, however, be open to young men also, and will make an excellent introduction to a professional or business career.

ART.

Miss Lana A. Baldwin

Miss Mary Kountz

The art department occupies the entire north front of the second floor in College Hall. The studios are large and well lighted.

The department has a very complete and carefully selected collection of casts from the antique including full length casts of the Venus de Milo, Borghese Warrior, and the Winged Victory.

The equipment for work in the handicrafts includes work benches and full sets of tools for each individual student electing work in metalry and jewelry, potter's wheels for throwing and casting pottery and a china kiln of the largest size for firing china.

There is a fine collection of works on art in the library suitable for class reading and serious study, also photographs from foreign countries and reproductions of celebrated pictures.

1—**Drawing** from the cast in charcoal, pencil crayon or pen and ink. Also still life and object drawing. I and II. 2-6. T. Th., 9 to 11.

2—**Painting** in water color and oil.

(a)—Work from nature and still life. Prerequisite. Art 1. I and II. 6.

(b)—Illuminating on vellum or parchment. Prerequisite. Art 1 and Art 7. I or II. 2-4.

3—**Architectural Drafting.**—Study of architectural shades and shadows, also conventional rendering in wash and color. Freehand perspective sketching from mechanical drawings. Sketching from nature when weather permits, in pencil and water color. I. 3.

4—**Drawing from Nature.**—In pencil, pen and ink, wash and color. This is intended especially for students in biology. I. 2. T. Th., 10 to 12.

5—**Clay Modeling.**—Decorative work from original designs, given in connection with study of historic ornament and design. I or II. 2.

6—**History of Art.**—This work is intended especially for students in design. Particular attention is given to the study of historic ornament and the classic styles as exemplified in painting, sculpture and architecture. I and II. 2.

7—**Design.**—Study of applied design and incidentally the use of water colors. Students submit original designs. I and II. 2-4.

8—**Design.**—Decorative design for home science students including the study of costume, design for embroidery, etc. Household decoration and color. I and II. 2-4.

9—**Design.**—Study of applied design for the decoration of china. This includes study of color. I and II. 2.

10—**Painting on China.**—Students to be admitted to the classes in china painting must satisfy the instructor that they have the necessary preparation to undertake the work profitably. China is fired in the studio. Prerequisite, 1, 2, 9. I and II. 2-8.

11—**Leather.**—Tooling, modeling and embossing; also use of dyes and stains for leather. Prerequisites, 7. I and II. 2-4.

12—**Jewelry.**—Making of simple and unique jewelry in silver and in copper. This includes saw-piercing, enameling, repousse and the setting of semi-precious stones. Prerequisite, course 7. I and II. 2-6.

13—**Metal.**—Work in copper, brass and silver. This course includes raising, saw-piercing, etching, hard and soft soldering and riveting. Prerequisites Art 7. I or II. 2-6.

14—**Pottery.**—The making of pottery is taught by means of the potter's wheel, casting from molds and throwing; and also hand-building, glazing and firing. Prerequisite, Art 7. I or II. 2-6.

BIOLOGY.

Professor Cooley
Professor Swingle
Assistant Professor Spaulding

The biology department now occupies the whole of the building formerly used also by the Experiment Station and agricultural departments. The building has been remodeled and made more suitable for biological work.

In the basement is a class room, an herbarium room and rooms for storage. One large room is devoted to receiving and unpacking apparatus and supplies and for rough storage. The entire west half of the first floor is a large laboratory for the use of students. This is equipped with large heavy tables, individual lockers and apparatus cases as necessary, and accomodates thirty students. The east half of the first floor is occupied by the office of the department, a private laboratory for the station entomologist and the department library.

The laboratories on the second floor accomodate about fifty students and are equipped with heavy tables with drawers. These rooms are supplied with gas. Individual lockers and cupboards for the convenience of students in bacteriology, physiology and general botany and zoology are in these rooms.

Opening off the bacteriological laboratory are three culture rooms for transferring bacteria without danger of contamination and an incubator room where an incubator and parafin bath are maintained at constant temperatures.

A greenhouse attached to the building on the south side contains a laboratory and a small hothouse. This laboratory and greenhouse combined are for the exclusive use of classes in plant physiology and plant pathology and are especially constructed to that end. Both are under glass and are provided with cement floors that plants may be carried from one to the other without suffering change of environment. Opening out of the physiological laboratory is a large dark room, with double doors, equipped for experiments illustrating the action of light and darkness on the behavior and growth of plants.

The greenhouse is attractively furnished with plants, both ornamental and illustrative; and the laboratory has aquaria in which running water keeps algae and other aquatic plants growing the year round.

Among the more important pieces of apparatus available for work in the various branches of botany and zoology are the following: Forty-six compound microscopes, seven of which are equipped with excellent oil immersion lenses of the best makes in this country and Europe. Beside the regularly required lenses attachable to these microscopes are a fine series for special purposes, including those made especially for photo-micrographic work; a Filar micrometer and several stage and eye-piece micrometers for the accurate measurement of microscopic objects; four dissecting microscopes with rack and pinion adjustment of the lenses, of which there is a series with each instrument; twenty-two very serviceable dissection microscopes of less expensive construction; one rotary microtome for rapid and fine work, one Minot automatic precision sliding microtome especially constructed for sectioning wood and well adapted for general work; a large supply of dissecting instruments; two paraffin baths with attachments for maintaining a constant temperature; a good working set of stains and other chemicals for histological work in both animal and vegetable tissues; two incubators with constant temperature attachments, serviceable in embryological and bacteriological work; one large size eclipse type of autovalve, the most up-to-date and serviceable of any now available; one hot-air sterilizer of the large improved Lautenschlager type; one Koch sterilizer; one Arnold sterilizer; one Ganong Clinostat; one Draper self-recording thermometer; one Draper self-recording hygrometer; six auxonometers; two photosynthometers; two respirometers; two potometers and six warm stages.

Besides the pieces above listed the department owns a large quantity of general apparatus, glassware and chemicals, sufficient for giving, in a thorough manner, all the sub-courses listed in this department.

It is the purpose of the biological library to furnish the students with full and up-to-date knowledge of all zoological, botanical and bacteriological subjects taught at the college and such special subjects as may be taken up for research work.

Of the larger and more important works are Saccardo's "Sylloge Fungorum" for the identification of fungi; Engler and Prantl's "Pflantzenfamilien," covering the entire plant kingdom; DeToni's "Sylloge Algarum" for the algae and the Kew Index and Britton and Brown's "Illustrated Flora of North America," relating to the flowering plants, and most of the more important classic and recent works on plant morphology, physiology and classification and on the various phases of bacteriology. There are also several hundred pamphlets dealing with special lines of botanical work, and a full set of bulletins of the state experiment stations and the U. S. Department of Agriculture, which are rich in research papers on botanical subjects.

To keep up with the most recent discoveries, we receive regularly a number of the best botanical periodicals published in this country and abroad, and we are constantly adding to our library as our special needs require.

The department is well equipped with necessary zoological literature.

Special attention has been paid to accumulating titles relating to entomology and physiology, as well as general zoology. Among the more important books may be mentioned the following: Genera Insectorum (complete), Zoological Record, Entomological News (complete), Canadian Entomologist (complete), Zoologische Anzeiger, Anatomischer Anzeiger, Psyche (complete), Transactions of the American Entomological Society. Besides these there are a large number of books treating of the various branches of zoological science. These, together with a large number of unbound pamphlets, constitute a good working library.

The department has purchased the entomological section of the Concilium Bibliographicum and is a subscriber to the additional cards. This catalogue and one of about 35,000 references, made by the department, are of great service in facilitating the library work of the students in entomology.

A large, well selected, and rapidly growing series of microscopical mounts, including histological preparations of animal and vegetable tissues, bacteria and dissected parts of plants and animals is available for the use of students and is of great value in their instruction.

For preparing lantern slides, prints and other illustrative material for the students, for illustrating thesis and research papers and to acquaint the student with photographic methods, the biology department is provided with several good cameras. Among these are a 5x7 camera provided with a Bausch and Lomb make of the Zeiss convertible anastigmatic lens, series VII, a lens for general use, and a Bausch and Lomb photomicrographic outfit, including one special lens and two specially constructed microscope objectives. There are two dark rooms, one exclusively for photographic use and one in connection with the physiological laboratory used for photographic work during vacations and at other times when not in use by students in their experiments with plants. A good supply with chemicals for making the various developers, etc., is always on hand.

On the third floor opposite the museum, is a well lighted lecture room which can be quickly darkened for the use of the electric lantern on a raised platform in the rear of the room. Fully one thousand lantern slides are in the department for use in illustrating the lectures. A large part of the Kny series of botanical charts in colors and in black and white, and a series of zoological charts after Leukart are also used with the lectures.

(1) **Invertebrate Zoology**—Devoted to the study of the invertebrate animals, including their morphology, development, habits, economic or popular interest, and classification. The broad biological principles are brought out and emphasized. The class room work is based on Hegner's "Introduction to Zoology." The laboratory exercises include a study of the morphology of types, reference reading and practical work in the classification of the animals. Required of agricultural and general science students except those in the mathematics and physics group. Lec-

tures, 2; laboratory, 2. I, 4. Assistant Professor Spaulding. M. W., 8 to 9; W. F., 1 to 3.

(2) **Vertebrate Zoology**—A continuation of (1), taking up vertebrate (chordate) forms. Required of agriculture and biology students. Elective for those who have taken (1). Lectures, 1; laboratory, 3. II, 4. Assistant Professor Spaulding. Hours to be arranged.

(3) **Animal Physiology and Anatomy**—By means of lectures and demonstrations the main principles of animal physiology are presented to the students, while in the laboratory they become familiar with the most important features of mammalian anatomy. Required of agriculture, home science, pharmacy, and biological students. Elective for general science students who have taken (1). Lectures, 3; laboratory, 2. II, 5. Assistant Professor Spaulding. Th. 8 to 9; M. W. 9 to 10; W. F. 1 to 3.

(4) **General Entomology**—Lectures on the morphology, metamorphoses and classification of insects and a study of the various orders. Collecting, naming, labeling and arranging in museum form species that are to be found in the vicinity of Bozeman. Required of biology and agricultural students. Elective for others who have taken (1). Lectures, 2; laboratory, 2 or 4. Professor Cooley. M. W. 9 to 10; T. Th. 1 to 3.

(5) **Advanced Entomology**—This course is a continuation of the general entomology course (4), and is made up of lecture, reading and conference work and of laboratory exercises. Students in this course will be assigned laboratory work best suited to their special requirements. Forestry students will take up a detailed study of the insect pests of the forest, while regular biology students will be assigned more technical subjects. Lectures, 2; laboratory, 2. II, 4. Professor Cooley. M. W. 9 to 10; T. Th., 1 to 3.

(6) **Economic Entomology**—Principles underlying insect depredations and their control; insecticides and insecticide machinery; notable insect pests of our time and of earlier times; entomological journals and early literature; prominent workers of today and earlier times. Lectures, 3; laboratory, 1. II, 4. Professor Cooley. Hours to be arranged.

(9) **General Botany**—Morphology, anatomy and elementary physiology of plants, including life history studies of all the groups. The fundamental biological principles are here laid down on which all higher botanical studies are based. Required of all science and agriculture students. Lectures, 2; laboratory, 3. I, 5. Professor Swingle. T. Th. 9 to 10; M. T. Th. 1 to 3.

(10) **Plant Physiology and Histology**—Experimental work in the movement, growth, nutrition and reproduction of plants with a microscopical study of the structures involved. Must be preceded by biology (9) and 1st sem. of chemistry (1). Required of agriculture and biology students. Lectures, 1; laboratory, 3. II, 4. Professor Swingle. M. 1 to 3; T. 9 to 11; Th. 8 to 10; F. 10 to 11.

(11) **Plant Pathology.**—General facts and principles governing the health and disease of plants, with illustrative experiments, followed by a

study of the classification, morphology, and special physiology of parasitic plants, with especial reference to diseases of cultivated crops in Montana. Must be preceded by (9) and (12). Required of agronomy and horticultural students. Lectures, 1; laboratory, 3. II, 4. Professor Swingle. T. 10 to 11; T. W. Th. 1 to 3.

(12) **Bacteriology.**—A study of the structure, life history and classification of bacteria, their growth in nutrient media, and methods of bacteriological technique. The relation of bacteria to agriculture, disease, and our daily life is discussed. Must be preceded by biology (9) or (3) and chemistry (1). Required of agriculture and home science students. Lectures, 2; laboratory, 3. I, 5. Professor Swingle. T. Th. 10 to 11; F. 1 to 3; T. Th. 8 to 10.

(13) **Embryology.**—An introductory course in embryology, embracing a study of the formation and growth of tissues in the vertebrate body, based chiefly on a study of the chick, but including consideration of the development in the mammalia. Open to students who have completed biology (2) or (3). Lecture, 1; laboratory, 3. I, 4. Assistant Professor Spaulding. Hours to be arranged.

(14) **Organic Evolution.**—A lecture course treating of the different evolution theories and their present status; will also include such topics as the origin of species, heredity, variation, natural and artificial selection, adaptations, etc. Lectures and assigned reading. Required of agriculture and biology students and elective to students who have completed at least two courses in biology. Lectures, 2. II, 2. Assistant Professor Spaulding. T. Th. 11 to 12.

(15) **Thesis.**—Students in the biology course in their senior year and seniors from other courses, who have had sufficient previous training in biology, may devote a maximum of five credits per semester to thesis work, under the direction of Professors Cooley or Swingle, or Assistant Professor Spaulding.

CHEMISTRY.

Professor Cobleigh

Mr. Barnes

The applications of chemistry to the various phases of agriculture, to engineering and to many modern industries, make this science an important one in a technical school. The fundamental courses of the science should be thoroughly taught in order that the student may have sufficient training and independence to apply his knowledge to practical operations. If the student is to master the principles of chemistry and at the same time obtain a working and practical knowledge of chemical manipulation, he must have certain facilities at his disposal.

Below is given a somewhat in detail, a description of the equipment and the conveniences provided for the study of chemistry in this institution:

The lecture room, with raised floor and seating capacity for one hundred and fifty students, has a lecture desk provided with water, gas, and electricity, a demonstration balance and stereopticon for showing the

applications of the science. The class room exercises in general and applied chemistry are illustrated by experiments, lantern slides, and in many cases by exhibits of the raw materials and finished products of commercial processes. The lecture room equipment is in an adjoining room, which also serves as a private laboratory.

There are five laboratories equipped for the following lines of work: General chemistry, qualitative and quantitative analysis, organic and food chemistry, physical chemistry, and assaying. All desks are provided with water, gas, electricity, and filter pumps where needed. The hoods in each laboratory are furnished with gas and water and connections from a large Parson's hydrogen sulphide generator which will supply forty jets at one time. In each hood there are large steam and air baths in operation at all times, being connected to the steam heating plant. The building is well ventilated by means of a mechanical draft, and heated by a direct-indirect steam system. With some of the classes working in sections the laboratories will accommodate 150 students.

The store room is stocked with an ample supply of the apparatus and chemicals needed for the various laboratory courses. The student secures what equipment he needs from time to time, in addition to that always kept in his desk, from the store keeper, who is on duty at convenient and stated hours. The equipment includes, besides the usual stock of apparatus, much that is designed for special use, such as accurate balances for both quantitative analysis and assaying, standard weights, equipment for calibrating measuring apparatus, polariscopes, Abbe refractometer, oil testers, apparatus for water, air, and gas analysis, combustion furnaces, Hoskin's crucible and muffle furnaces for assaying and for experiments necessitating high temperatures, apparatus for gas density determinations, Beckman's freezing and boiling point apparatus, and equipment for conductivity measurements, etc.

The department museum occupies a well lighted room in the basement. In this room are stored in cabinets, and glass exhibit cases, the collections illustrating chemical industries of various kinds, and the mineralogical and geological specimens. The mineral collection is quite extensive. It includes a valuable private collection purchased by the college some years ago. To this was added a part of the Montana mineral exhibit at Chicago in 1893, and large additions have been made from time to time through exchanges and purchases. The collection is thoroughly representative and forms an important adjunct to the chemical department.

The chemical library and office is located on the first floor and contains full sets of the American Journal of Science, Journal of the American Chemical Society, Journal of the (London) Chemical Society, Berzelius Jahresbericht, Bericht der deutschen Chemischen Gesellschaft, and Fresenius Zeitschrift fur Analytische Chemie. There are also partial sets of Chemical News, and the Analyst. Besides these the library contains many standard reference works and the recent text books. There are

also index volumes and card catalogues to facilitate more ready reference to the literature.

(1) **General Chemistry.**—Two lectures, one recitation and one 2½ hour laboratory period per week throughout the year on the fundamental laws of chemistry, the history, occurrence, preparation and properties of the common elements and their compounds. High school physics is prerequisite. Text books, Smith's College Chemistry and Lenher's Laboratory Manual. I and II, 8. Lecture M. W., 9 to 10. Quizzes, 3 sections, Th. 8 to 9; M. W. 11 to 12. Laboratory, 3 sections, M. W. F. 1 to 3:30.

(2) **Qualitative Analysis.**—Lectures and recitations two hours per week on the theory and practice of qualitative analysis. Laboratory practice two afternoons per week in the analysis of simple salts, complex mixtures, ores and minerals. Text book, Qualitative Analysis by Baskerville and Curtman. I, 4. M. W. 10 to 11. Tu. Th. 1 to 3:30.

(3) **Quantitative Analysis.**—Two lectures and recitations per week on the theory and technique of the laboratory methods and chemical calculations. Five hours of laboratory work per week. The analyses required in the course include the following: Magnesium sulphate, potassium alum, iron ammonium alum, iron ore, limestone, clay or slag, zinc, lead, copper, manganese, arsenic, antimony, and nickel ores alkalimetry, acidimetry coal and flue gas. Chemistry (1) and (2) are prerequisite. Text books, Miller's Notes on Quantitative Analysis for Mining Engineers, Treadwell's Quantitative Analysis, and Miller's Calculations of Analytical Chemistry. II and I, 8. M. W. 10 to 11. Tu. Th. 1 to 3:30.

(4) **Organic Analysis.**—Lectures and recitations on the methods used for the anaylsis of organic substances and agricultural products. The laboratory portion of the course includes analyses of the following: Feeding stuffs and cereals, fertilizers, soil, sugar, milk, butter, oils, alcohol, glycerol, formaldehyde, and the detection of adulterations in food. Chemistry (3) and (5) are prerequisite. Text book, Proximate Organic Analysis by Sherman. I and II, 8. Hours to be arranged.

(5) **Organic Chemistry.**—An elementary course designed to make the student familiar with the principles of organic chemistry and with the more important compounds of both the aliphatic and the aromatic series. Remsen's Organic Chemistry is used in the class room and the laboratory work is based on Orndorff's Laboratory Manual, and Gaetterman's Practical Methods of Organic Chemistry. Chemistry (1) is prerequisite. II, 5. Tu. Th. F. 9 to 10. T. Th. 1 to 3:30.

(6) **Advanced Inorganic Chemistry.**—Lectures and recitations on general theoretical chemistry in which special attention is given to the study of the elements according to the periodic classification of Mendeleeff. Chemistry (1), (2) and (5); (3) or (7) are prerequisite. I and II, 6. Hours to be arranged.

(7) **Agricultural Chemistry.**—This course is designed especially to meet the needs of the students in the four year course in agriculture. Lectures and recitations on the chemistry of soil, manures and fertilizers, plants, and animal products. The laboratory work includes the following

analyses: Magnesium sulphate, potassium alum, iron and ammonium alum, limestone, soil, cereal or feeding material, milk or butter. Text books, Ingle's Manual of Agricultural Chemistry, Lincoln and Walton's Quantitative Analysis for Agricultural Students. Chemistry (2) and (5) are prerequisite. I, 4. W. F. 10 to 11. W. 1 to 3. Sat. 8 to 10.

(8) **Food Chemistry.**—This course is designed for students in the home science and the two year pharmacy courses. The first few weeks of the course deal with organic chemistry which will serve as a preparation for the study of the composition of different foods, and their functions, the preservation and adulteration of foods. The class work will be supplemented with appropriate laboratory exercises. Chemistry (1) is prerequisite. Text books, Outlines of Organic Chemistry by Moore, Sanitary and Applied Chemistry by Bailey. I, 5. T. Th. F. 9 to 10. T. Th. 1 to 3:30.

(9) **Engineering Chemistry.**—Lectures and recitations on the industrial applications of chemistry to engineering problems. In general the course includes fuels, refractory materials, limes, mortars, and cements, timber and its preservation, iron and steel, water, illuminating gas, explosives, and lubricating oils. The lectures are supplemented by laboratory exercises in quantitative analysis. Chemistry (1), (2), are prerequisite. I or II, 5. Hours to be arranged.

(10) **Water and Air Analysis.**—A course designed for students in sanitary engineering. The sanitary analysis of water and air, with discussions on the proper interpretations of analytical results. The first semesters of chemistry (3) and chemistry (5) are prerequisite. Text books, Mason's Water Supply, and Richard and Woodman's Air, Water and Food. II, 2. Hours to be arranged.

(11) **Animal Nutrition.**—Lectures on the functions of fats, carbohydrates, protein, and salts in nutrition together with a study of the chemistry of digestion and metabolism. Chemistry (5) or (8), and Biology (3) are prerequisite. Text book, Chemistry of Food and Nutrition by Sherman. II, 3.

(12) **Mineralogy.**—Blowpipe analysis, elementary crystallography and determinative mineralogy. Lectures and laboratory work. Text book, Moses and Parson's Mineralogy. I, 3 or 4. Hours to be arranged.

(13) **Assaying.**—Conferences, recitations, and laboratory work. Testing the purity and reducing power of fluxes, fire assay for lead, gold, and silver ores, and gold and silver bullion, chlorination assay, cyanide and amalgamation tests. Chemistry (3) and (12) are prerequisite. Text book, Fire Assaying by Fulton. II, 4. Hours to be arranged.

(14) **Photography.**—Lectures on the chemistry and manipulation of photographic processes. Demonstrations in exposing, developing, printing, toning, making lantern slides and enlargements. I, 2. T. Th. 10 to 11.

(15) **Seminar-Abstracting.**—In order to develop in the student a habit of careful reading, each student will be required to make abstracts of articles on assigned subjects from the leading journals, and present them at weekly meetings of the students and department instructors,

where the topics are freely discussed. Students are thus kept in touch with the progress of the science. I and II, 2.

(16) Thesis.—Students in the chemistry course are required in the senior year to prepare a graduating thesis on some subject which will involve considerable laboratory work and as much originality as possible. I and II, 4.

ENGLISH.

Professor Brewer

Assistant Professor Duddy

The library has abundant equipment for all the work offered in English. There are complete standard texts of practically all the authors referred to in any of the courses. Besides these there is a fair supply of biographical, critical and historical works, sufficient for ordinary reference use. The library equipment is complete enough so that thus far students have been able to do the reading assigned without the necessity of purchasing many books.

Though many classic novels are to be found on the shelves, no effort has been made in the college library to provide current fiction.

In all the courses in English, written work plays an important part. That this work may be kept up to the proper grade, it is announced here that in college English work no paper will receive any credit that shows notable carelessness or ignorance in elementary matters of punctuation, grammar, rhetoric, or in the spelling of common words.

(1) **English Composition.**—The course is required of all freshmen. The course is almost altogether practice in various types of prose composition; narration, description, exposition, criticism, and argumentation. The class meets ordinarily twice a week. The instructor from time to time meets each student for private conference about his work. Lectures. I and II, 4. Prof. Brewer and Assistant Prof. Duddy. Two divisions. M. W., 10 to 11. T. Th., 11 to 12.

(2) **Expository Composition.**—This is a course primarily in expository writing and intended for students who will go into scientific or technical work. Papers prepared in scientific or technical courses, if not too technical, may be handed in as part of the work of this course. The year's work will also include some practice in argumentative writing in preparation for English (5). I and II, 4. Prof. Brewer. Two divisions. T. Th., 8 to 9. T. Th., 10 to 11.

(3) **Advanced Composition.**—This is an advanced course for those who wish to study composition as a fine art. It will include a study of the historical development of English prose style and such other work as may suit the taste or needs of those who elect the course. Lectures. I and II, 4. Prof. Brewer. Hours to be arranged.

(4) **Public Speaking.**—Informal lectures; drill in articulation and intonation. Declamation exercises with criticism by instructor and students. Extemporaneous speaking and training in the writing of the different forms of public discourse. The course will close with a study of the essential principles of debating; each student will be required to take

part in at least one debate. Required of all freshmen. I and II, 2. Mr. Duddy. Two divisions. F., 9 to 10. W., 11 to 12.

(5) **Argumentation and Debating.**—Study of the principles of argumentation and master pieces of forensic oratory. Preparation of briefs and forensics. Conferences, lectures, debates and other forms of public address. Elective for seniors and juniors who have credit for courses (1), (2) and (4). I and II, 4. Mr. Duddy.

(6) **Interpretive Reading.**—This course will include work in the cultivation of the voice and the study of gesture, together with a large amount of drill in interpretive reading from standard literature, both prose and poetry, and especially in oratory and the drama. It is intended for those who expect to take part in oratorical or declamatory contests, and in college plays. It is elective for sophomores, juniors, and seniors. Prerequisite, English 1 and English 4. With the consent of the instructor, it may be taken in the first half-year separately. I and II, 4. Mrs. Herrick.

(10) **English Literature.**—A reading course in English literature including about twenty of the more important authors. A large amount of reading is required and more recommended. Written reports on the reading are frequently required. A part of the class room time is given to critical reading of English masterpieces. Lectures, recitations, and conferences. I and II, 4. Prof. Brewer. M. W. 9 to 10.

(11) **English Essayists of the Nineteenth Century.**—A study of the more important essayists from Charles Lamb to R. L. Stevenson. Lectures and recitations. I and II, 4. Prof. Brewer. Hours to be arranged.

(12) **Shakespeare.**—A careful reading of three plays in the class room, and outside reading in other plays of the period. Lectures and recitations. II, 4. Prof. Brewer. Hours to be arranged.

(13) **Victorian Poetry.**—A study of the poetry of the Victorian period, with special reference to the work of Alfred Tennyson, Robert Browning, and Matthew Arnold. Lectures and recitations. I and II, 4. Prof. Brewer. Hours to be arranged.

Course 10 is given every year and is prerequisite to courses 11-13. Courses 11-13 are not all given in the same year. Classes will be organized when a sufficient number of students elect any course.

Special Assigned Composition.—In accordance with a vote of the faculty, any college student who in any department hands in a theme, thesis, examination paper, lecture notes, or other written work which shows deficiencies in English, may be referred to the department of English with the paper in question and work will be assigned him of such kind and amount as to provide against any recurrence of poor work. Satisfactory completion of any such assignments will be requisite for graduation, but no credits will be allowed for this work.

Special Credits.—Students who enter inter-collegiate or inter-class debates or the oratorical contests, or who work upon the college papers or do other newspaper work, may have that work credited to them in this

department in amount as may be agreed with the head of the department, either in place of other required work in English, or as elective work.

GEOLOGY.

Mr. Barnes.

The vicinity of Bozeman is an excellent locality for the student of geology. It affords many opportunities for studying the action of forces now in operation and also for observing the effects these forces have produced in the past. The geology of this locality has been worked out by the U. S. Geological Survey and the Survey publications are in the college library.

The college museum contains excellent collections of minerals, rocks, and fossils, which are used for class room study. A set of lantern slides is used for illustrating the lectures.

(1) **Geology.**—Lecture, recitations, and assigned reading in dynamical and structural geology. Text book, Scott's Introduction to Geology. Chemistry (1), prerequisite. II, 3.

HISTORY.

Miss Brewer.

The department has a set of MacCoun's historical charts of the United States and two sets of historical geography charts of Europe by the same author; Johnson's series of maps of ancient geography; ten of Bretschneider's maps of medieval Euope; and a set of maps of the modern world.

The library contains the laboratory of the historical department, but a catalogue of the histories would be too voluminous to include here. In Greek and Roman history, besides the standard narrative works, there are translations of the best source material for this period. For English history the library is well equipped with general works and has source material including Colby, Lee and the University of Pennsylvania collection, Evelyn's Diary, a file of "The Gentleman's Magazine," etc.

Naturally the works on the United States history are the most numerous. The standard general histories, as well as works on limited periods or regions, and the best biographies of American statesmen, are in the library. The reports of the American Historical Association, and the Congressional Records, come to the library. There are also many contemporary records, among which are the Old South Leaflets, Hart's American History Told by Contemporaries; the complete works of Jefferson, Hamilton and other statesmen, and the Jesuit Relations.

The college reflectoscope is available for showing pictures of historic scenes and objects. A large number of views belonging to the teacher are used in all classes.

(1) **European History.**—It is taken for granted that the student has had a preparatory course in general history, with some such text as Myers or West. In this course special attention is paid to English history, and the student's work is supplemented by lectures on the development of continental Europe. Cheyney's History of England and Chey-

ney's Source Book are texts in the hands of the class, and special topics with library references are occasionally assigned. I and II, 6. M. W. F. 10 to 11.

(2) **Medieval History.**—The student is supposed to have had courses which have given him knowledge of the great epochs in history and their relations to each other. Therefore, in this course he will take up the thorough history of one period. He will be encouraged to form his own opinions by the use of such historical sources of this period as are available in translations. In this connection the student will be given practice in the application of the fundamental rules used in testing the value of historical material. I and II, 6. M. W. F. 8 to 9. (Given in 1911-12).

(5) **American History.**—This is a course in United States history covering the period of constitutional development and with special reference to that development. The use of the library rather than of any text book is required in this course, and the student is expected to spend about one-fourth of the time in the preparation of a paper on some selected subject. Course 2 should precede this course. I and II, 6. (Given in 1912-13).

(6) **Thesis.**—For research work in his senior year the student is allowed to select any historical subject which he is qualified to investigate; and for which some material is available either in translation or original.

HOME SCIENCE.

Professor Harkins.
Miss Ballinger.
Miss Hess.

The third floor of the new agricultural building is occupied by the home science department. At the north are two kitchen laboratories, on either side of the hall. One, 34x26 feet, has two coal ranges, several electric stoves and desks for 16 students. The other, 27x26 feet, has one coal range and fourteen desks, fitted with individual gas stoves. All tables are well supplied with cooking utensils. Adjoining the east kitchen is a model dining room, and beyond it the department office. With the other kitchen is a student lunch room, 25x23 feet, connected by folding doors with the class room. There are also store rooms, pantries and cold storage rooms.

In the south end of the building is a large sewing room, 47x31 feet, with a class room, 31x16 feet, two small fitting rooms, and cases for the work of 104 students. Connected with these are two small sewing rooms, and a bed room. The department has nine sewing machines of various makes, two electric irons, cases for exhibition work, and large and small work tables.

(1) **Principles of Cookery.**—This work includes both lecture and laboratory work on the composition and preparation of foods. Lectures on marketing and care of food materials; also visits to the various markets. The object of the course is to teach plain cooking based upon scientific principles. Norton's Food and Dietetics is the text book used. Lecture, 1. Laboratory, 3. II, 4. T. Th. 9 to 11. W. 1 to 3:30.

(2) **Food Studies.**—This course is designed to make practical application of the science underlying the selection and preparation of foods. The dishes prepared illustrate the scientific principles involved. Prerequisites, home science (1), chemistry (1) and (5). Lecture, 1, laboratory 3. II, 4. Th. 9 to 10. M. T. Th. 1 to 3:30.

(3) **Household Architecture and Sanitation.**—The surroundings, situation, and plan of the house; heating, lighting, plumbing and drainage. Each student makes the skeleton plan of a house. Lectures. II, 2. M. W. F. 10 to 11.

(4) **Advanced Cooking**—In this course menus are planned and meals prepared. For examination each student does her marketing and prepares a meal without assistance. The student also has instruction in the makng of a few difficult and fancy dishes. Prerequisites, home science (1) and (2). Laboratory 2. I, 2. M. W. 8 to 10.

(5) **Home Nursing and Invalid Cookery**—The work in home nursing includes lectures and demonstrations by local physicians and trained nurses. Invalid cookery includes a consideration of the diet under abnormal conditions; the preparation of invalid dishes; and the dietetic treatment of certain diseases. Prerequisites, home science (4). Chem. (5), Biol. (12). Laboratory 2. II, 2. M. W., 8 to 10.

(6) **Dietetics**—This course treats of the fundamental principles of human nutrition and metabolism, the relation of food to health, and the construction and preparation of dietaries. Prerequisites, home science (2). chemistry (5), biology (12). Lecture 1, laboratory 1. I, 2. Th., 11 to 12. M. 1 to 3:30.

(7) **Topical Course**—Topics relating to home science are assigned and discussed. II, 2.

(8) **Teachers' Course**—In this course both the theory and practice of teaching domestic science is given. A study is made of the courses of study in various institutions. Courses of study are planned for graded schools, high schools, and colleges. Each student has work in practice teaching. Prerequisites, home science (1), (2), (3), (4), (5), (6), and (7). I and II, 5. T. Th., 11 to 12.

(11) **Elementary Clothing.**—The fundamental principles of hand and machine sewing applied to the making of aprons and undergarments. Taking measurements, drafting, use of patterns and computation of cost. The drafting system and apron materials are included in the fee. Other materials provided by the student, subject to approval of instructor. Finished garments are the property of the student. I, 3. T. Th. F. 1 to 1:30.

(12) **Dressmaking.**—A course in sewing applied to the making of shirtwaists and simple cotton dresses. Designing and drafting patterns. Computation of costs. I, 2. M. W. 9 to 11.

(13) **Textiles.**—This course comprises a study of fabrics, beginning with their place in primitive life and tracing their development, manufacture, and economic value up to the present time. Prerequisites, chemistry (1); home science (11) and (12). I, 2.

(14) **Advanced Dressmaking.**—This course includes the making of a woolen dress or suit and a dress for afternoon or evening wear. II, 3. M. W. F. 1 to 3:30.

(15) **The Teaching of Domestic Art.**—This course deals with the methods of teaching domestic art; lesson plans; courses of study; equipment and practice in teaching. Prerequisites, home science, (11), (12), (13), (14). I, 3. M. W. 11 to 12. F. 9 to 10.

(16) **Embroidery.**—This course deals with the principal stitches used in decorative art. The decoration of household linens, undergarments and dresses is given attention. II, 2. T. Th. 1 to 3:30.

LATIN.

Miss Brewer.

(1) **Virgil.**—Six books of the Aeneid are read. Metrical reading of Latin is required constantly. The students are encouraged to make metrical translations and paraphrases. Recitations. I and II, 8.

(2) **Livy and Horace.**—The special aim in this year's work, as in the previous course, is to enable the student to acquire facility in reading and a literary appreciation of the authors read. Recitations. I and II, 4. T. Th. 9 to 10.

MATHEMATICS.

Professor Tallman
Miss Bull

The students in this department have access to the following journals: American Journal of Mathematics (complete set); Annals of Mathematics (from 1900); Bulletin of American Mathematical Society (1898 to date); also about 200 volumes of recent treatises on mathematics. It may also be mentioned that our library is especially well equipped with treatises and journals of applied mathematics found in the libraries of the engineering and physics departments.

(1) **Algebra.**—Beginning with a review of radicals and quadratic equations, the course includes progressions, arrangements and groups, binomial theorem, theory of limits, undetermined co-efficients, logarithms, and an introduction to the theory of equations. I, 3. M. W. F. 8 to 10, and M. W. F. 10 to 11.

(2) **Plane Trigonometry.**—For engineering and science students. I, 2. T. Th. 10 to 11.

(2a) **Plane Trigonometry and Logarithms.**—For agricultural and home science students. I, 3. M. T. Th. 11 to 12.

(3) **Analytical Geometry and Calculus.**—This course includes the geometry of the straight line and conic section coupled with the elements of different calculus. II, 4. M. T. W. Th., 8 to 9. M. T. Th. F. 10 to 11.

(4) **Analytical Geometry and Calculus (continued).**—This course which deals largely with the differential and integral calculus also takes up some problems in analytical geometry not treated in course (3), especially the geometry of three dimensions and also includes an intro-

duction to differential equations. I and II, 10. M. T. W. Th. F., 9 to 10.

(5) **Method of Least Squares.**—I, 2. M. W. 8 to 9.

(6) **Theoretical Astronomy.**—Integration of equations of motion, computation of orbits and ephemerides. This course should be preceded by course (5) in physics and must be preceded by course (4) in mathematics. I and II, 6.

(7) **Applied Algebra**—This course is designed for students who do not expect to go further into the study of mathematics. Starting with a review of some of the fundamentals of elementary algebra the course deals with such subjects as ratio and proportion, mathematical inductions, probable results and errors from experimental data, etc., as will assist the students in their scientific work. For agricultural and home science students. II, 2. M. W. 8 to 9.

(10) **Differential Equations**—Ordinary and partial differential equations with geometrical and mechanical applications. I and II, 6. M. T. Th. 8 to 9.

(11) **Partial Differential Equations of Mathematics-Physics**—This course will be based on Weber's "Die Partiellen Differential Gleichungen der Mathematischen Physic," and Byerly's "Spherical Harmonics." A great many applications to concrete problems will be made throughout the course. I and II, 6.

(12) **Newtonian Potential**—Lectures on the theory of potential, with an introduction to spherical harmonics. I and II, 4.

(13) **Algebra (Advanced)**—This course will be an extension of course (1), and will contain discussion of complex numbers, theory of algebraic functions, etc. Care will be taken to show the practical application of each subject as the work advances; that is, such subjects as the connection between complex numbers and alternating currents, etc., will be fully explained. I and II, 6.

(14) **Analytical Geometry (Advanced)**—This course is a continuation of course (4). As the time given in course (4) for geometry of three dimensions is very limited it will receive considerable attention in this course. I and II, 6.

(15) **Thesis**—Students specializing in mathematics are required to present a thesis on some chosen subject. The subject must be chosen and approved not later than November 15 of the senior year. A great deal of work in this line is desired, as it is believed there is no better way of developing a habit of independent thought.

Only a selection of courses (10) to (14) will be given each year, those being chosen for which most students apply. The special object of our work here is to make the course in applied mathematics complete, and the work in pure mathematics will have as its object the laying of a good foundation for the more advanced work in applied mathematics. Those desiring to do work which is not offered in the above courses may consult the professor in charge of the department.

MODERN LANGUAGES

PROF. CURRIER.
MR. PERRINE.

The modern language department is well represented in the college library. The list includes the standard works in German and French literature in the original, as well as complete translations of the more important writers.

Many works of historical and critical nature and a number of standard lexicons may also be consulted. Several foreign language periodicals are at the disposal of students.

(1) **French**—The study of French is begun in the freshman year, and the first year's work includes a thorough study of the elements of grammar, careful reading, with translation, of 300 pages of easy French, composition, practice in pronunciation and oral reading. Fair facility in sight reading is expected at the close of the year. I and II, 8. M. Tu. W. F. 8 to 9.

(2) **French.**—In the sophomore year, in addition to easy texts and further study of grammar and composition, the classics, prose and poetry will be read, and also some scientific French, thus cultivating in the student an appreciation of the best foreign literature. The chief aim of the course is the acquisition of practical reading knowledge. I and II, 6. M. T. Th. 11 to 12.

(3) **French.**—An elective course in the French classic drama and nineteenth century fiction is offered to juniors and seniors. I and II, 6.

(10) **German.**—This course is open to college students who have not had high school or preparatory German. The work of the first year includes careful study of the elements of grammar, composition, pronunciation, conversation, the reading of easy texts, and sight reading. I and II, 8. M. T. W. F., 8 to 9.

(11)) **German.**—A continuation of the above course. The work consists largely of reading of practical nature, with some introduction to the classics. Further attention will be paid to grammar and composition. If requested, scientific German will be read. I to II, 8. M. T. W. Th., 11 to 12.

(12) **German.**—This course, open to freshmen, is a continuation of the course offered in the preparatory department, and can be taken only by students who have had two years of German previously. The classics will be studied; also scientific texts if desired, and some attention will be given to composition and conversation. I to II, 8.

(13) **German.**—An elective course offered to those who have completed course (11) or (12). It consists chiefly of advanced reading of a practical, scientific or literary character, as the needs of the students electing it may dictate. I and II, 4.

PHILOSOPHY AND ECONOMICS.

President Hamilton.

(1) **Psychology.**—This course presents a general view of modern psychology and is required of all general science students. It gives a

practical exposition of the materials and methods of psychological investigation. The lectures are accompanied by class demonstrations. Attention is given to such topics as the growth of the central nervous system, the nature of consciousness, sensory and motory training, the higher intellectual faculties, and the will. So far as possible the work is made practical and concrete. I, 3. M. T. Th., 9 to 10.

(2) **Ethics.**—The work in ethics includes a study of the evolution of conduct, moral standards, the social and industrial life, the development and trend of ethical thought and an examination of utilitarianism. Required of general science students. II, 3. M. T. W., 9 to 10.

(3) **Economics.**—This course consists of a study of such subjects as land, capital, labor, money, coinage, banking, rent, interest, wages, and taxation. The most important questions in economics of the present time are considered. Among these may be mentioned trusts, labor organizations, government ownership of public utilities, cooperation, recent currency legislation, and the single tax. I and II, 4. M. W., 11 to 12.

(4) **Sociology.**—The origin and history of human society, the various social theories and the laws of human intercourse are treated. Attention is given to such practical subjects as the government of cities, settlement work, the enrichment of country life, and charity work. Lectures and recitations. Elective. I or II, 3.

PHYSICS.

Asst. Professor Ham.

The following courses in physics are designed to meet the needs of (1) those students who are preparing to take up some of the more technical studies in engineering or agriculture, (2) those who expect to become physics or science teachers, and (3) those general science students who wish to acquire some of that kind of scientific training which is peculiar to the science of physics alone.

The facilities at the disposal of the physics department are described below somewhat in detail.

The lecture room is located in the basement of the chemistry and physics building. The lecture desk is supplied with gas and both alternating and direct current circuits. A projection lantern is permanently set up and is used constantly to illustrate the class room exercises. A large collection of lantern slides has been prepared, which cover the whole subject of physics. The apparatus for lecture demonstration has been carefully selected and is sufficiently complete for giving experimental illustrations of all the principles of the science that are usually included in college courses.

For laboratory instruction three well lighted and conveniently furnished rooms are provided on the second floor of the building.

One of these rooms is equipped for electrical measurements and is wired with both alternating and direct current circuits, conveniently arranged for experimental purposes. The galvanometers are perman-

ently located in convenient positions. The following forms are available: tangent, astatic, Thompson, differential, Northrup, and eight forms of the D'Arsonval type, including two with ballistic suspensions. In addition to the above equipment the following instruments are used in the various experiments taught, viz: magnetometer, standard resistance and condenser, an air condenser for determining the ratio of the electrostatic to the electromagnetic units, Carhart-Clark cells, wire and box forms of the Wheatstone bridge, Carey Foster bridge, Callendar and Griffith's bridge, rheometer, electro-dynamometer, ammeters, voltmeters, Leed's potentiometer, platinum thermometer, thermocouples, earth inductor, standard solenoid, Thompson integrating wattmeter, and a permeameter with ten different specimens of iron for experiments in magnetization and hysteresis.

The second laboratory is furnished and equipped for teaching mechanics and heat. The equipment includes the following: micrometer and vernier gauges, spherometer, cathetometer, balances and weights, hydrometers, Atwood's machine, Young's modulus apparatus, torsion apparatus, torsion pendulums, apparatus for resolution and composition of forces, impact, harmonic motion, principle of moments, centrifugal force, and surface tension; simple and Kater's pendulums, a laboratory clock, thermometers, air thermometer, calorimeters, expansion apparatus, hygrometers, Searles' mechanical equivalent of heat apparatus.

The third laboratory is used for the study of light and sound and also for the elementary classes in the preparatory school. The equipment for teaching light and sound includes the following: a photometer, spectrometer, spectroscope, mirrors, prisms, lenses, diffraction gratings, optical bench, Fresnel mirror and bi-prism, apparatus for polarized light, microscope, telescope, and an Abbe refractometer, sonometers, Kundt's tubes, siren, Lissajous apparatus, and Helmholtz resonators.

For the study of radioactivity and allied phenomena, there is a large induction coil, a variety of Crookes' and X-ray tubes, Wilson electroscope, radium compounds and other radio-active material.

The physics library is located in one of the laboratories for students' use. It contains many of the best books and general works on physics, and the current numbers of the Philosophical Magazine, the Physical Review, Science Abstracts, Section A, Bulletins of the Bureau of Standards, and School Science and Mathematics.

(1a) **General Descriptive Physics.**—Two lectures, and laboratory work two and one-half or five hours per week in mechanics, heat, light and electricity. Special attention is given in this course to the study of such physical principles as those involved in the capillary action of soils, the osmotic action of plants, the movements of winds and moisture, the causes of the deposition of dew and the prevention of frost. Physics (1a) is prescribed in the courses in agriculture and biology. Mathematics (2) or (2a) and high school physics are prerequisite. Text books, General Physics, by Crew; Laboratory Course, by Sabine; La-

boratory Physics by Miller. I and II, 6 or 8. M. W., 11 to 12; M. 1 to 3:30.

(1) **General Physics.**—Lectures, recitations, and assigned problems, three hours per week throughout the year on mechanics, heat, magnetism, and electricity. This course is more mathematical and technical than physics (1a) and is particularly designed to meet the needs of students in engineering and the science students in the mathematics-physics course. Students who have not completed the calculus, mathematics (4), are required to take it during the same year that physics (1) is taken. Text book, General Physics, by Hastings & Beach. I and II, 6. M. W. F., 10 to 11.

(2) **Physical Measurements.**—A laboratory course designed to supplement physics (1). It is strictly quantitative and is given for the purpose of providing laboratory illustrations of fundamental principles of the science and to offer a training in making measurements of precision. Text books, Mechanics, Molecular Physics and Heat, by Millikan; Laboratory Physics, by Miller. I and II, 4. T. Th., 1 to 3.

(3) **Light and Sound.**—Lectures and recitations two hours per week on wave motion, the theory of light in its appliaction to familiar optical phenomena and to optical instruments, and on the phenomena and laws of sound. Prerequisites, physics (1) and (2). . Text books, Light and Sound, by Franklin & McNutt. II, 2. T. Th., 8 to 9.

(4) **Physical Measurements.**—A laboratory course in light and sound to supplement physics (3). II, 2.

(5) **Electricity and Magnetism.**—Two lectures and two laboratory periods per week on methods for the exact measurements of resistance, electromotive force, current, capacity, and the co-efficient of self-induction. The calibration of commercial instruments, insulation, testing, and magnetic measurements, such as finding the permeability and the hysteresis effects of different samples of iron, will also be included in this course. Physics (1) and (2) and differential and integral calculus are prerequisite. I, 4. T. Th., 8 to 9; W. F., 1 to 3.

(6) **Advanced Physics.**—Physics (6) is primarily a laboratory course and is offered as an elective to science and engineering students. Conferences and assigned reading are essential features of the course. A more complete study of the precision of measurements will be made than was attempted in physics (2).

There are four separate parts to this course from which the work desired may be selected.

(a) **Heat.**—A study of exact methods of thermometry, pyrometry, calorimetry and determination of the mechanical equivalent of heat. Physics (1), (2) and (5) are prerequisite. II, 3.

(b) **Light and Radicactivity.**—Conferences, assigned reading and a series of standard laboratory experiments to illustrate diffraction, interference and polarization of light, spectroscopy, photometry, conduction of electricity through gases, and the phenomena of radioactivity. Physics (3) and (4) are prerequisite. II, 3.

(c) **Electricity and Magnetism.**—This course is offered as an elective in the science and electrical engineering courses to those who wish to continue the subject beyond the requirements of physics (5). I, 3.

(d) **Pedagogy of Physics.**—This course will be modified from year to year to suit the needs of the individual student. In general the course will include discussions of the methods of teaching, the selection and performance of effective lecture table and laboratory experiments and practice in presenting the topics covering such experiments to elementary and college classes. Physics (1, 2, 3 and 4) are prerequisite. I, 3.

(7) **Thesis.**—Students in the mathematics-physics group who elect physics as their major subject are required in the senior year to prepare a graduating thesis on some subject which will involve considerable laboratory work and as much originality as possible.

School of Art

Miss Baldwin
Miss Kountz

That the study of drawing is important in education is now universally acknowledged. Aside from the advantages to engineers, machinists, and architects of practical knowledge of draughtsmanship, the psychologic value of a knowledge of drawing is very great. The chief object of education is in the quickening of the powers of the mind. Drawing brings out the power of analysis, habits of observation, qualities of judgment, imagination, memory and taste. It is something more than mere training of the eye. To achieve even moderate success requires that thought be put into every line. A line put down without thought is always a wrong line.

Art, aside from anything we can produce, helps us to appreciate the work of great artists and opens our eyes to the beauty of form and color in nature. It extends our powers of enjoyment and gives us a better understanding of the history of human spirit. It gives a proper gratitude for the work of the great artists.

With the coming of the applied arts movement, has come the demand for work in manual training directly related to, and based upon art principles. With this purpose in view courses are offered in artistic handicraft, jewelry, hammered metal, pottery and leather work with all the facilities and equipment needed for artistic and practical work.

Students who are registered in the art courses are admitted without further tuition fees to such other work of the college as their preparation will permit them to pursue to advantage. Attention is called in this connection to the work offered in history, literature, languages, home science, music (which is charged separately) and in engineering and

mechanic arts. The art course, as here outlined, will indicate the work of the average student in a four year's course planned for those who attend mainly for art work. All the teaching being individual, the student is carried forward just as rapidly as his own talent and industry will permit.

The course offers thorough training in the study of form, color, ornament, historic art, principles of design and composition and in technical methods in applied design. It insures a broad foundation of art culture and skill which will enable students to make practical use of their training. The theory of design is presented as fundamental to the crafts. Exceptional facilities are offered for the study of design and composition and the course is strengthened by the many phases of related art work carried on in the school. Every effort is made to teach drawing. The pupil is then encouraged to follow any line of art work for which he seems best fitted. For example, a pupil may elect to specialize in handicraft. Having completed the required work in drawing and design he may study any handicraft for which he has developed some ability or shown especial talent.

Attention is called to the regulation printed on page 18 regarding work done suitable for exhibition purposes.

Art schools unrelated to colleges have often lacked the finer influences of literature, the broadening environment, the healthy stimulus of systematic work and the wider circle of social life. It is thus a decided advantage for the art school to have the association with the religious, social and literary life of the college.

For admission to the course in art, the requirement is the same as for the regular degree course, fifteen units of preparatory or high school work. For a detailed statement of the requirements see page 14.

ART COURSE.

FIRST YEAR.

First Semester.		Second Semester	
Eng. Comp. (Eng. 1)	2	Eng. Comp. (Eng. 1)	2
German or French	4	German or French	4
Drawing (1)	6	Drawing	7
Design	4	Design	4
Perspective and Comp	1	History of Art	2
History of Art	2		

SECOND YEAR.

English (10)	2	English (10)	2
German or French	4	German or French	4
Drawing	5	Drawing	5
Painting	2	Painting	2
History of Art	2	History of Art	2
Design and Handicraft	4	Design and Handicraft	4

THIRD YEAR.

History (1)	3	History (1)	3
Drawing and Painting	6	Drawing and Painting	6
Advanced Design and Handicraft	6	Advanced Design and Handicraft	6
Elective	4	Elective	4

FOURTH YEAR.

Drawing and Painting	6	Drawing and Painting	6
Advanced Design and Handicraft	6	Advanced Design and Handicraft	6
Elective	7	Elective	7

For a description of the art work outlined above see pages 71 and 72 of this catalogue.

School of Music

JAMES M. HAMILTON, M. S.,
President of the College.
EARLE B. OLIVER, (Toronto Conservatory of Music)
Director of Music School and Instructor in Voice.
PAUL P. McNEELY, Mus. B. (Washburn Col.); A. B. (Univ. of Kansas.)
Instructor in Piano and Musical Theory.
MISS REGINA BARNES (Wooster Conservatory.)
Instructor in Piano, Organ and Theory.
LOUIS L. HOWARD,
Director of Band and Instructor in Band Instruments.

ADVANTAGES OF COLLEGE INSTRUCTION.

The advantages of college over private instruction are very numerous and quite obvious to any one giving the matter serious thought. When a student is seeking the services of a private teacher, he must form his judgment as best he can on that person's fitness for his vocation, while it is certain that the teachers of a successful college are selected mainly on account of their ability, as it would not be in the best interests of such an institution to sacrifice its reputation by employing other than good teachers. Again, the stimulating atmosphere of a music school is another distinct advantage over private instruction.

The music departments are organized for a four-fold purpose:

1. To combine music and literary studies as a broad basis for regular collegiate instruction.
2. To use the art of music for intellectual, esthetic, and moral culture.
3. To teach all branches of music to special and general students.
4. To educate teachers of music.

DEPARTMENTS OF INSTRUCTION.

I. Course for the pianoforte.
II. Course for the voice.
III. Course for the organ.
IV. Course for harmony, counterpoint, analysis, and history of music.
V. Course for orchestral and band instruments.
VI. Instruction in chorus singing.

GENERAL INFORMATION.

1. No time limit can be designated for the satisfactory completion of any course on account of difference in degree of musical ability; much also depends upon the preparation made, and upon the amount of time and careful attention the student can devote to the pursuit of a chosen study.

2. Students who present themselves as candidates for graduation must have completed a first grade high school course or its equivalent and give evidence of requisite musical talent and capacity. Each

student must give during the last year of study one public recital in addition to the final performance at the commencement concert. Students preparing for graduation are required to take two private lessons a week for two years, and it is necessary that resident students should study with teachers of the college for at least two years.

3. For graduation, one semester's work in rudiments and four semesters' work in harmony will be required, and one year in the history of music.

4. The study of music has been placed in the science division upon equality with other electives, and a limited number of credits may be counted toward a degree.

5. Diplomas will be granted to students who have done satisfactory work and passed the required examinations.

6. Tuition rates are payable in advance for each term of twelve weeks. No reduction will be made for temporary absence from lessons or for lessons discontinued. Lessons missed by the teacher will be made up at the mutual convenience of teacher and pupil.

7. All college students who take work in music shall be enrolled in at least twelve credits of work (including, if so assigned, work in harmony and musical history) in addition to the work in vocal and instrumental music. Students residing at home may be excused by the faculty from such requirements, upon request of their parents. Work is recommended in home science, languages, literature, history and art.

Students not candidates for a preparatory diploma or a college degree, who are taking music in combination with other work of the college, shall be registered by the head of the department of home science.

Those students not taking other college work are classed as "Music Specials."

8. The department is closed on the college and national holidays. Lessons falling on these days will not be made up.

9. No student is permitted to take part in any public performance without consent of the director.

10. Tuition fees are subject to change from year to year.

EQUIPMENT.

The Department of Music of the college occupies the first half of the third floor of College Hall. The school is well equipped with pianos, both grand and upright.

CONCERTS AND RECITALS.

Concerts are frequently given by the instructors and advanced students.

Recitals are given monthly by the students of the school, at which work studied in the class room is performed before a small audience of fellow students and friends. Every student is required to take part in the programs at least twice a year. These semi-public appearances are of great assistance in enabling the student to acquire the ease and self-possession so essential to a successful public performance.

ENSEMBLE AND SIGHT PLAYING.

In this branch of instruction lie indispensable elements of musical culture, to be obtained through no other mode of training.

Ensemble training developes the pupil's ability in reading at sight, and enables them to acquire a knowledge of compositions ordinarily inaccessible to the piano-forte student.

Prima-vista reading of four-hand arrangements, and transcriptions of the symphonies, operas, string quartettes and chamber music generally, for two pianos, are studied. Piano accompaniment playing for voice and solo instruments receives special attention.

PIANO DEPARTMENT.

The course in piano-forte is covered by five grades, Preparatory, Freshman, Sophomore, Junior and Senior. Examinations will be held twice a year—at the end of each semester. Regular students may not pass from any grade to the next without examination. While it is not obligatory for students to take these examinations, yet they are encouraged to take them because they have something definite before them, their ambition is stimulated and a better quality of study is secured. The pieces used for these examinations will be chosen from a list arranged by the director of the music department.

Special attention will be paid to the following points in the examinations:

Excellence of technique.
Accuracy of notation and correctness of fingering.
Phrasing and rhythm.
Discretion in use of pedals.
Choice of tempo and steadiness in time.
Quality of touch and tone.
Artistic interpretation.
Memory playing.
Playing at sight.

PREPARATORY PIANO COURSE.

Technical exercises—Rieman and later Phillipp, throughout all courses.

Czerny-Germer, Studies II; Duvernoy, School of Mechanism, op. 120; Koehler, op. 50; Heller, op. 45 and 47; Kuhlau's Kinderleben; Sonatas by Clementi and Kuhlau.

COLLEGIATE PIANO COURSE.

FRESHMAN EXAMINATIONS.

Candidates must be prepared to play from memory six pieces or sonatas, such as Mendelssohn's Songs without Words; Schubert's Impromptus; Sonatas by Haydn and Mozart; or other appropriate selections from classic and modern compositions.

Technic.—All scales, hands together, in quarter, eighth, and sixteenth, separately, staccato and legato; triads in all keys; arpeggios in three positions, hands separately.

Studies.—Czerny, School of Velocity; Cramer, Studies; Bach, Two-part Inventions, and French Suites.

SOPHOMORE EXAMINATIONS.

Candidates must be prepared to play from memory eight pieces selected by the instructor, one number of which must be by Bach, and one number of the eight must be prepared without assistance.

Appropriate selections from classic and modern compositions will be studied including Beethoven's Sonatas; Concertos by Mozart, Hummel, etc.

Technic.—All scales, hands together, in quarter, eighth and sixteenth notes, metronome at 69. Triads and four-note chords with different touches. Arpeggios formed on all major and minor triads with their inversions, metronome at 84, hands separately. Staccato octaves in any scale required.

Studies.—Cramer, Studies, continued; Clementi, Selections from Gradus au Parnassum; Jensen, op. 32; Bach, Three-part Inventions and English Suites.

JUNIOR EXAMINATIONS.

Candidates must be prepared to play from memory eight pieces selected by the Instructor, one number of which must be by Bach, one by Beethoven, and one by Chopin or Schumann. One number of the eight must be prepared without assistance.

Concert selections from classic and modern composers will be studied including Chopin's Preludes; Bach, Well-Tempered Clavichord; Concertos by Beethoven, Mendelssohn, etc. Selections from Henselt's op. 2 and 5.

Technic.—Major and minor scales, hands together, similar and contrary motion, metronome at 105. Also major scales, hands together in thirds, sixths, and tenths, metronome at 100. All chord forms. Arpeggios formed on the major and minor chords and on the diminished seventh chords, with inversions, metronome at 92. Staccato octaves in major and minor keys, hands together.

Studies.—Gradus continued; Moscheles, Etudes, op. 70; Kullak, School of Octaves; Chopin, Etudes.

SENIOR EXAMINATIONS.

Candidates must be prepared to play from memory eight pieces selected by the instructor, one number of which must be by Bach, one by Beethoven, and one by Chopin or Schumann. One number must be a concerto. One number of the eight must be prepared without assistance.

Concert selections from Schumann's greatest works (David Bundler-Tanze or Carnaval); Sonatas and Concertos by Beethoven, von Weber, Grieg, etc. and pieces by modern composers.

Technic.—All major and minor scales in octaves, tenths, sixths, and thirds, metronome at 120. Scales must also be played with crescendos and dimuendos, two notes against three, and three notes against four.

All chord forms, solid and broken, with any touch required. Arpeggios formed on all major and minor chords, also the dominant seventh, and diminished seventh chords, all with inversions, metronome at 108. All octave forms will be required.

Studies.—Chopin's Etudes, op. 10 and 25; Rubinstein, Selected Studies; Bach, Well-tempered Clavichord, continued.

MUSICAL THEORY.

The following courses are required of all students in the regular musical courses.

1. Harmony.—The study of overtones, scales, intervals, triads, and seventh chords and their inversions. The practical work consists of harmonizing melodies in soprano or bass and playing chord progressions at the piano. First year, twice a week first semester.

2. Harmony.—The study of close and open harmony, dominant ninth and diminished seventh chords, modulations. Practical work continued. First year, twice a week; second semester.

3. Harmony.—The study of modulation, irregular resolutions, altered chords, suspensions, passing tones, organ point, harmonization of florid melodies. Practical work continued. Second year, twice a week first semester.

4. Musical Analysis.—Review of harmony, analysis of two and three part song and song with trio. Classical models with original work. Second year, twice a week second semester.

5. Musical History.—A survey of music from the earliest times. Lectures, discussions, and assigned readings. First year once a week, first semester.

6. Musical History.—This course deals principally with modern music. Lectures, reports and class discussions. First year, once a week, second semester.

VOCAL DEPARTMENT.

Instruction in this department includes every thing that assists in the development of the vocal artist, among which details of study may be mentioned the union registers; solfeggii and application of words to music; exercise for obtaining flexibility of voice; exercises in the scales, major and minor, and chromatic, and arpeggios; dramatic and lyric expression.

No student of vocal art can reasonably hope to achieve any great degree of proficiency without a certain amount of general culture. To this end harmony should be studied; languages, especially Italian, French and German are recommended; a good command of English is very necessary; and every singer ought to be able to play piano accompaniments of songs.

Candidates for graduation must have completed a high school course or its equivalent; four years' voice work; one year of harmony and history of music. Technique studies and songs of the four years course are carefully selected and graded to meet the needs of the student.

Songs include selections from classic and modern composers. Solfeggien exercises include works of Concone, Vaccai, Mazzoni, Sieber, Aprile, Winter, Crescentini, Rossini, etc.

College Choristers.—This club consists of twenty-two members under the direction of Prof. Oliver. Students who have suitable voices, and who read music with sufficient facility are admitted. The Choristers meet weekly, preparing standard choruses and part songs, from classical and modern composers, which are given publicly from time to time.

CALENDAR FOR 1911-12.

The music department has divided the year into three terms of twelve weeks each, or if desired, lessons may be arranged by the College semester.

1911—September 11—Fall term registration begins.
—December 5—Fall term closes.
—December 6—Winter term begins.
1912—March 6—Winter term closes.
—March 7—Spring term begins.
—June 3—Spring term closes.

TUITION.

With Mr. McNeely.

For one forty-five minute lesson per week for one term	$25.00
For two half hour lessons per week for one term	32.00
Harmony, for the entire academic year (two lessons a week)	20.00

With Miss Barnes.

For one forty-five minute lesson per week for one term	$18.00
For two half hour lessons per week for one term	22.00
Harmony, for entire academic year (two lessons a week)	20.00
History, for entire academic year (one lesson a week)	15.00
Organ, one hour lesson per week for one term	24.00

With Mr. Oliver.

One forty-five minute lesson per week for one term	$18.00
Two half hour lessons per week for one term	25.00

Students wishing to arrange for vocal or instrumental instruction by the single lesson instead of by the term will be charged $1.50 per half-hour lesson.

Piano practice may be arranged for at the following prices:
One hour each day 30 cents per week.
Two hours each day 50 cents per week.
Organ practice: One hour each day, 25 cents.

School of Pharmacy

Professor Mollet.

This school offers two and three-year courses which afford a thorough training in all branches of pharmacy and pharmaceutical chemistry. These courses lead to the degree of Pharmaceutical Chemist (Ph. C.), and qualify the graduate who has had the required experience to meet the examination given in any state for the position of registered pharmacist.

The two-year course requires two full academic years for completion and provides the foundation in chemistry and pharmacology as applied in the various pursuits of the profession of pharmacy.

The three-year course includes the same subjects in chemistry and pharmacy and affords the student an opportunity of extending his pharmacy education with advantage, over a period of three years. This course is especially recommended to applicants who are not high school graduates, or otherwise well qualified to pursue the two-year course.

Candidates for admission must be at least eighteen years of age, unless they are graduates of accredited high schools, or of schools maintaining courses of equal length and rank, and may be admitted: (a) by presenting a certificate of graduation from an accredited high school; (b) by presenting a certificate from an accredited high school, signed by the principal or superintendent, showing that not less than one year of work has been completed; (c) by an examination on an equivalent amount of work in subjects designated by the college; (d) by faculty approval of grades from other than accredited high schools.

Notice is hereby given that the requirements for these courses will be raised in the future.

While it is not compulsory, it is advised that students have one or two years practical training in a drug store before entering.

Applicants who furnish the regular college entrance requirements, fifteen units, and complete sixty-five credits of approved work in the college in addition to those outlined in the two-year course may receive the degree, Bachelor of Science (B. S.) in Pharmacy.

In addition to the annual tuition fee of $12.00, deposits are required as indicated on page 13.

The students have access to such of the chemical and botanical laboratories as the work calls for, as well as those of pharmacy and materia medica. Those laboratories contain all the modern equipment necessary for the proper instruction of the students. Free access is also granted to the standard reference books in the several branches of science, and the magazines and journals of chemistry and pharmacy.

Lectures will be given throughout the course on chosen subjects, by those who have gained prominence in pharmaceutical pursuits, and in the sciences closely related to pharmacy. All pharmacy students will be required to attend these lectures, for which a credit of one hour is given for the semester.

All regular students will be required to keep notes on the work done, and present the same for examination and rating. Oral and written quizzes will be given during each course, and a final written examination at the close of the senior year covering the entire course of instruction in pharmacy. This examination will resemble those given by the state boards of pharmacy.

This school was officially recognized by the State Board of Pharmacy, April 12, 1910, and graduates, upon payment of the regular fee, may receive their certificates of registration without examination, as follows: Those furnishing satisfactory evidence to the Board of having had one year of practical experience in a drug store, may become Assistant Registered Pharmacists, and those having had four years practical experience, may become Registered Pharmacists.

PHARMACY.

Three Year Course.

FIRST YEAR.

First Semester		Second Semester	
English (1 or b, c or d)	2 or 4	English (1 or b, c or d)	2 or 4
Introductory Pharmacy (Phar.1)	4	Official Galenical Pharmacy (Phar. 3)	4
Pharmaceutical Problems (Phar. 2)	2	Pharmacy Laboratory (Phar. 4)	2
General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
	12 or 14		12 or 14

SECOND YEAR.

Qualitative Analysis (Chem.2)	4	Quantitative Analysis (Chem. 3)	4
General Botany (Biol. 9)	5	Plant Phys. and Hist. (Biol. 10)	1
Pharmacy Latin (Phar. 12)	3	Physiology (Biol. 3)	5
		Pharmacognosy (Phar. 5)	3
	12		13

THIRD YEAR.

Organic Chemistry (Chem.8)	5	Physiological Chem. (Chem. 11)	2
Bacteriology (Biol. 12)	2	Microscopical Study of Powdered Drugs (Phar. 7)	2
Pharmacopoeial Salts (Phar. 6)	5	Materia Medica, Therapeutics and Toxicology (Phar. 9)	4
Pharmacopoeial Testing and Drug Assaying (Phar. 8)	3	Prescription Reading and Dispensing (Phar. 10)	3
		Urine Anal. (Phar. 11)	2
	15		13

Two-Year Course.

FIRST YEAR.

General Chemistry (Chem. 1)	4	General Chemistry (Chem. 1)	4
General Botany (Biol. 9)	5	Plant Phys. and Hist. (Biol. 10)	1
Introductory Pharmacy (Phar.1)	4	Physiology (Biol. 3)	3
Pharmaceutical Problems (Phar. 2)	2	Official Galenical Phar. (Phar. 3)	4
Pharmacy Latin (Phar. 12)	3	Pharmacy Laboratory (Phar. 4)	2
		Pharmacognosy (Phar. 5)	3
	18		17

SECOND YEAR.

Organic Chemistry (Chem. 8)	5	Quantitative Analysis (Chem. 3)	4
Qualitative Analysis (Chem. 2)	4	Physiological Chemistry (Chem. 2)	2
Bacteriology (Biol. 12)	2	Microscopical study of Powdered Drugs (Phar. 7)	2
Pharmacopoeial Salts (Phar. 6)	5	Materia Medica, Therapeutics and Toxicology (Phar. 9)	4
Pharmacopoeial Testing and Drug Assaying (Phar. 8)	3	Urine Analysis (Phar. 11)	2
		Prescription Reading and Dispensing (Phar. 10)	3
	19		17

DESCRIPTION OF WORK IN PHARMACY

(1) **Introductory Pharmacy.**—This course consists of a study of the authoritative guides; the theory in the use of the common apparatus and processes used in pharmacy; together with practical laboratory training in the use of this apparatus and these processes. Lectures and recitations, 3; laboratory, 1. I, 4.

(2) **Pharmaceutical Problems.**—Two hours per week devoted to the study of the principles of pharmaceutical arithmetic and to practical problems involving weights and measures, relationship of systems, specific gravity and specific volume, reducing and enlarging formulas, percentage solution, concentration and dilution, alligation and thermometric scales. Recitations. I, 2.

(3) **Official Galenical Pharmacy.**—A continuation of course (1) and must be preceded by it; consisting of a thoroughly scientific study of the galenical preparations in the United States Pharmacopoeia and National Formulary. These are carefully considered with regard to classification, nomenclature, mode of preparation, preservation, and percentage composition. Texts, U. S. Pharmacopoeia, eighth revision, and National Formulary, third edition. Lectures and recitations. II, 4.

(4) **Pharmacy Laboratory.**—A practical laboratory course in which many of the important and difficult medicinal preparations of the U. S. Pharmacopoeia and National Formulary are manufactured by each student, especially the typical representatives of each class of galenicals,

viz: waters, liquors, decoctions, infusions, syrups, mucilages, honeys, glycerites, elixirs, spirits, tinctures, wines, vinegars, fluidextracts, extracts, oleoresins, resins, collodions, emulsions, mixtures, pills, powders, granular effervescent salts, cerates, ointments, liniments, oleates, plasters and suppositories. II, 2.

(5) **Pharmacognosy.**—A study of the natural history and important features of crude drugs; the means of identification and selection; constituents, and official preparations. The official organic drugs and some of the commonly used non-official ones will be studied in the following order: (a) Plant drugs—Roots, rhizomes, tubers, bulbs, corms, herbs, barks, twigs, woods, leaves, flowers, fruits, seeds, gums, resins, balsams, etc.; (b) Animal drugs. The student has actual access to the typical specimens in the materia medica laboratory. Lectures, recitations, and laboratory exercises. II, 3.

(6) **Pharmacopoeial Salts.**—The official inorganic and organic salts, acids, and the official alkaloids, alkaloidal salts and glucosides are studied with special reference to nomenclature, source, manufacture, physical and chemical properties. Lectures and recitations. I, 5.

(7) **Microscopical Study of Powdered Drugs.**—This course consists of the study of powdered vegetable drugs and their common adulterants by the aid of the microscope. By the preparation of slides and drawings the student learns the most important characteristics of the different drugs most commonly adulterated and their common adulterants, and is thus enabled to determine questions of identity and purity. Laboratory 2. II, 2.

(8) **Pharmacopoeial Testing and Drug Assaying.**—This is chiefly a practical laboratory course in the analysis and standardization of the inorganic medicines, chemicals, organic drugs and preparations, according to the methods of the United States Pharmacopoeia. One recitation and two laboratory periods. I, 3.

(9) **Materia Medica, Therapeutics and Toxicology.**—Lectures and recitations on the physical, physiological and therapeutic properties of medicines, together with their classification and dosage. Special attention is also given to methods of detection, antidotes and toxic posology of the more commonly used remedies. I,, 4.

(10) **Prescription Reading and Dispensing.**—A technical study of all phases of the prescription, practical exercises at sight reading and in the art of extemporaneous compounding. I, 3.

(11) **Urine Analysis.**—Two credits per week devoted to the study and estimation of the constituents of urine in health and disease. II, 2.

(12) **Pharmacy Latin.**—An elementary course in Latin syntax, with a study of Latin pharmaceutical terms. I, 3.

The Preparatory School

Miss Mary A. Cantwell, Principal.

The preparatory school is maintained for the benefit of the young people who live in counties not having high schools, or in the rural districts not convenient to the city high schools and for those who wish industrial training with their high school course. With the large and well equipped kitchen.. sewing rooms, shops and laboratories, the work ranks with that of the best secondary industrial schools. Many members of the college faculty give preparatory instruction in their special subjects.

For admission to the preparatory school the equivalent of an eighth grade certificate is required. Those not having eighth grade certificates will pass an examination in the common branches, or otherwise satisfy the principal before entering classes.

Military drill is required of the boys and physical culture of the girls.

A liberal course of reading is given in the English classics as a part of the required work. It is desirable, so far as possible, for students to purchase the books and make them a part of their private libraries.

Judge F. K. Armstrong, of Bozeman, gives a prize of ten dollars to the one taking first place in an annual declamatory contest. There is also a prize of five dollars for the second best. Only regular students in the preparatory school are eligible to enter this contest.

Beginning with the year 1911-12, Hon. Nelson Story Jr., will give twenty-five dollars annually for prizes in a contest in extemporaneous speaking, open to preparatory students only. The plan of the contest will be like that conducted for the high schools of the state in March, 1911. The contestants will speak for from five to eight minutes on a subject selected by them, some three hours before the time set for the contest, from a limited list prepared by a committee of the faculty.

Below are outlined three preparatory courses—the Scientific; and two industrial courses—Home Science and the Mechanic Arts. It will be noted that each of these courses includes the ten units required from all candidates for admission to college, as shown on page 14. For admission to college fifteen units of work are required; but the following courses, planned to occupy full four years, are based upon a minimum of sixteen units. A suitable diploma will be given upon the completion of any one of these courses.

A unit consists of work to the amount of four sixty-minute recitation periods per week for thirty-six weeks. Two periods of laboratory, shop work, home science, or drawing, shall count as one recitation period.

Irregular registration, except as necessitated by a student's previous work, is allowed by vote of the faculty only.

The subcourses in English, German, and Mathematics may be taken only in the order prescribed in the description of the work.

SCIENTIFIC COURSE.

FIRST YEAR.

First Semester		Second Semester	
English Composition (a)	4	English Composition (a)	4
Algebra ((a)	4	Algebra ((a)	4
Greek History (a)	4	Roman History (a)	4
Freehand Drawing (a)	2	Freehand Drawing (a)	2
Mechanic Arts (a) Boys	2	Mechanic Arts (a) Boys	2
Sewing (a) Girls	2	Sewing (a) Girls	2
	16		16

SECOND YEAR.

Rhetoric (b)	4	Rhetoric (b)	4
Algebra (b)	4	Plane Geometry (c)	4
Medieval History (b)	4	Modern History (b)	4
Biology (a)	3	Biology (a)	3
Freehand Drawing (b)	2	Freehand Drawing (b)	2
	17		17

THIRD YEAR.

Literature (c)	4	Literature (c)	4
Plane Geometry (c)	4	Solid Geometry (d)	4
Physics (a)	4	Physics (a)	4
German (a)	4	German (a)	4
Declamatory Practice (e)	1	Declamatory Practice (e)	1
	17		17

FOURTH YEAR.

Literature (d)	4	Literature (d)	4
Trigonometry (Math. 2a)	3	Physiology (b)	3
German (b)	4	German (b)	4
American History (c)	2	American History (c)	2
Reviews	4	Reviews	4
	17		17

HOME SCIENCE COURSE.

FIRST YEAR.

First Semester		Second Semester	
English Composition (a)	4	English Composition (a)	4
Algebra (a)	4	Algebra (a)	4
Greek History (a)	4	Roman History (a)	4
Freehand Drawing (a)	2	Freehand Drawing (a)	2
Sewing (a)	2	Sewing (a)	2
	16		16

SECOND YEAR.

Rhetoric (b)	4	Rhetoric (b)	4
Algebra (b)	4	Plane Geometry (c)	4
Biology (a)	3	Biology (a)	3
Freehand Drawing (b)	2	Freehand Drawing (b)	2
Cooking (a)	2	Cooking (a)	2
Sanitation (c)	2	Household Management (f)	2
	17		17

THIRD YEAR.

Literature (c)	4	Literature (c)	4
Plane Geometry (c)	4	Solid Geometry (d)	4
Physics (a)	4	Physics (a)	4
German (a)	4	German (a)	4
Dressmaking (b)	2	Dressmaking (b)	2
	18		18

FOURTH YEAR.

Literature (d)	4	Literature (d)	4
Trigonometry (Math. 2a)	3	Physiology (b)	3
German (b)	4	German (b)	4
Cooking (b)	2	Cooking (b)	2
Reviews	4	Reviews	4
	17		17

MECHANIC ARTS COURSE.

FIRST YEAR.

First Semester		Second Semester	
English Composition (a)	4	English Composition (a)	4
Algebra (a)	4	Algebra (a)	4
Freehand Drawing (a)	2	Freehand Drawing (a)	2
Mechanical Drawing (a)	2	Mechanical Drawing (a)	2
Wood Work (a)	2	Wood Work (a)	2
Forge Work (b)	2	Forge Work (b)	2
	16		16

SECOND YEAR.

Rhetoric (b)	4	Rhetoric (b)	4
Algebra (b)	4	Plane Geometry (c)	4
Medieval History (b)	4	Modern History (b)	4
Mechanical Drawing (b)	2	Mechanical Drawing (b)	2
Forge Work (c)	2	Pattern Making (e)	2
Foundry (d)	2	Foundry (d)	2
	18		18

THIRD YEAR.

Literature (c)	4	Literature (c)	4
Plane Geometry (c)	4	Solid Geometry (d)	4
Physics (a)	4	Physics (a)	4
Mechanical Drawing (c)	3	Mechanical Drawing (c)	3
German (a) or the following *	4	German (a) or the following *	4
Boiler Practice	1	Boiler Practice	1
Machine Work (h) or Wood Work (g)	2	Machine Work (h) or Wood Work (g)	2
	18		18

FOURTH YEAR.

English (d)	4	English (d)	4
German (b)	4	German (b)	4
Mechanism (d)	4	Mechanism (d)	4
Trigonometry (Math. 2a)	3	Physiology (b)	3
American History (c)	3	American History (c)	3
Steam Boilers (a) or Electrical Practice (a)	3	Steam and Gas Engines (b) or Electrical Practice (a)	3
Machine Work (j) or Wood Work (i)	2	Machine Work (j) or Wood Work (i)	2
Elective	2 to 4	Elective	2 to 4
	17 to 19		17 to 19

*Students who intend entering college are required to take German (a) in the third year and German (b) and English (d) in the fourth year. Students not intending to enter college may omit the German and English (d).

DESCRIPTION OF PREPARATORY WORK.

ENGLISH.

(a) **English Composition.**—The aim of the course is to secure accurate and effective expression, and to afford constant exercise in composition. In connection with this work English classics will be made the subject of class room study, forming a basis for the study of literature. I and II. 1 unit. M. T. W. Th., 1 to 2.

(b) **Rhetoric.**—This is a continuation of course (a). Each student is required to write at least one paper per week, based on text book work. I and II. 1 unit. M. W. Th. F., 10 to 11.

(c) **Literature.**—The object of this course is to develop an intelligent appreciation of American and English masterpieces and to promote a taste for the best literature. A series of classics similar in number and kind to the New England College requirements are the material for critical class room study. The student will find in the library valuable works of reference. I and II. 1 unit. M. T. W. Th., 11 to 12.

(d) **Critical Study.**—The purpose of this course is to apply the principles as laid down in composition and rhetoric. It will consist of a study of the classics, writing of themes, oral discussions and library and home reading assignments. I and II. 1 unit. M. T. W. Th., 1 to 2.

The following works are studied in class: Shakespeare's Merchant of Venice, and Macbeth; the Sir Roger de Coverley Papers from the Spectator; Irving's Life of Goldsmith; Coleridge's Ancient Mariner; Scott's Ivanhoe, and the Lady of the Lake; Tennyson's Gareth and Lynette, Lancelot and Elaine, and the Passing of Arthur; Lowell's Vision of Sir Launfal; and George Eliot's Silas Marner.

(e) **Declamatory Practice.**—A one credit course in declamatory practice is offered in third year scientific course. I and II. Th., 10 to 11.

MATHEMATICS.

(a) **Algebra.**—This includes the following subjects: Addition, subtraction, multiplication, division, equations of the first degree with one unknown number, simultaneous equations of the first degree, factors, highest common factor, lowest common multiple, quadratic equations, simultaneous equations above the first degree, theory of indices (positive, negative, fractional, and zero), and radicals. I and II. 1 unit. M. W. Th. F., 10 to 11.

(b) **Advanced Algebra.**—Simultaneous quadratic equations; ratio proportion and variation; graphical representation of simple relations between two variables; arithmetical and geometrical progressions; binomial theorem for positive integral exponents; logarithms, including use of tables in simple numerical work. I. ½ unit. M. T. W. F., 9 to 10.

(c) **Plane Geometry.**—This includes, in addition to the work given in the standard texts, a large number of original exercises. Prerequisite, algebra (a). II, 1. 1 unit. II. M. T. W. F., 9 to 10. I. M. T. W. F., 1 to 2.

(d) **Solid Geometry.**—In this course special attention is given to

the geometry of the sphere. Prerequisite, algebra (a) and (b) and geometry (c). II. ½ unit. M. T. W. Th., 1 to 2.

SCIENCE.

(a) **Elementary Physics.**—Lectures with experimental illustrations, recitations, assigned problems, and laboratory work four hours per week throughout the year, in mechanics, sound, heat, light, electricity and magnetism. Text book, High School Physics, by Carhart and Chute, and Laboratory Notes, by Cobleigh. I and II. 1 unit. M. W. F., 9 to 10; M., 2 to 4.

(a) **Biology.**—This course will be conducted in such manner as to give the pupils a good understanding of the first principles of the science of living things. While the subjects of the course will be taken from the field of zoology and botany, it is not the purpose to train zoologists and botanists, but to equip the pupils, by the information and training given, to observe and interpret simple biological facts. Recitations and laboratory exercises. I and II. ¾ unit. I. M. W., 11 to 12; W., 2 to 4. II. M. W., 11 to 12; Th., 2 to 4.

(b) **Elementary Physiology.**—An elementary course in physiology covering the main facts of general anatomy and physiology of the human body. Nutrition, the blood and circulation, respiration, excretion, nervous system and its functions, and the special senses are among the topics covered. II. ½ unit. M. W. F., 10 to 11.

GERMAN.

(a) **Beginning German.**—The work of the first year is of the usual elementary nature, including study of grammar, composition, pronunciation, careful reading of easy texts and sight reading. I and II. 1 unit. M. T. W. F., 10 to 11.

(b) **German Readings.**—The second year's work is also largely practical, but affords, as well, an introduction to classic German literature. The required reading during the two years is not less than 600 pages. I and II. 1 unit. M. W. F., 9 to 10; Th., 8 to 9.

SEWING.

(a) **Sewing.**—The fundamental principles of hand and machine sewing applied to the making of aprons and undergarments—students provide suitable materials. The finished work is the property of the student. I and II. ½ unit. F., 10 to 11; Th., 8 to 10.

(b) **Dressmaking.**—Designing, cutting and making simple dresses is a part of the work. I and II. ½ unit. T. Th., 8 to 10.

DRAWING.

(a) **Drawing.**—Freehand drawing from geometric solids and casts. Study of light and shade. Object drawing, in charcoal, pencil, and pen and ink. Study of linear perspective with practical exercises in perspective sketching. I and II. ½ unit. T., 2 to 4; F., 1 to 3.

(b) **Continuation of Course (a).**—Study of design and handicraft at discretion of instructors. I and II. ½ unit. M., 2 to 4; Th., 8 to 10.

HISTORY.

(a) **Greek and Roman History.**—The mastery of such a text as West's Ancient World or a briefer text on Greek and Roman history, with supplementary work in some simple source collection. Special attention is paid to the geography of the ancient world, and references to other books and occasional outside topics given to enable the students to grasp the subject rather than memorize the text. When possible, pictures of places or of objects of study are used. I and II. 1 unit. M. T. W. F., 9 to 10.

(b) **Medieval and Modern History.**—The second year is given to medieval and modern history, using the same methods. I and II. 1 unit. M. T. W., 1 to 2; Th., 11 to 12.

(c) **American History.**—The study of American history with special reference to the expansion of territory and the development of industrial, social and civic institutions. Lectures and text book supplemented by the use of sources and standard reference work. I and II. ½ unit. T. Th., 10 to 11; W., 11 to 12.

COOKING AND SANITATION.

(a) **Plain Cooking.**—This is a study of breads, meats, vegetables and cereals. Two laboratory periods. I and II. ½ unit. T., 10 to 12; W., 2 to 4.

(b) **Cooking.**—The work is both theoretical and practical. Williams and Fisher's text book is used. One lecture. One laboratory period. I and II. ½ unit. M., 8 to 9. I, W., 2 to 4; II, Th., 2 to 4.

(c) **Sanitation.**—This course covers a consideration of the house as regards its site, location, drainage, ventilation, heating, lighting and wawith experiments to illustrate the principles involved. I. ¼ unit. M. W., 8 to 9.

(f) **Household Management.**—This course deals with the organization of the household, expenditure of income, and the planning and selection of equipment and furnishings of the house. II. ¼ unit. M. W., 8 to 9.

MECHANICAL DRAWING AND DESIGN.

(a) **Mechanical Drawing.**—Lettering. The shape and proportions of letters, freehand construction. Freehand sketching of simple machine parts, reproduced in detailed working drawings. Orthographic projection in the third quadrant. I and II. ½ unit. T., 10 to 12; Th., 8 to 10.

(b) **Mechanical Drawing.**—A continuation of (a) in detail drawing, tracing and blue printing. Shades and shadows, isometric drawing, simple mechanical perspective. I and II. ½ unit. T., 10 to 12; Th., 8 to 10.

(c) **Mechanical Drawing.**—The elementary principles of the kinematics of machinery with such applications as to be of immediate utility in shop practice; the study of gears, screws, cams, bearings and quick-return mechanism. Six hours drawing per week. I and II. ¾ unit. W. Th., 2 to 4; Sat., 8 to 10.

(d) **Mechanism.**—A continuation of (c) in the study of bevel gears,

together with tests of the strength of various materials. Two hours gearing in train, roller bearings, belts and pulleys, rope and chain drive, recitation, four hours drawing per week. I and II. 1 unit.

SHOP WORK.

(a) **Wood Work.**—Joinery, consisting of a series of exercises designed to develop skill in the use and care of bench tools, and proficiency in reading simple working drawings. Turning, comprising spindle, face plate and chuck work in the manufacture of simple patterns and standard articles for shop use. House carpentry, illustrating the methods and principles of framing, rafter and stair cutting, mill work and finishing. Cabinet work, in which standard wood shop machinery is used in the manufacture of drawing tables, book and filing cases, office desks and other plain furniture, and including finishing in oil, stain, wax and varnish. Taken with mechanical drawing (a). I and II. ½ unit. M. W., 2 to 4.

(b) **Forge Work.**—The operation of hand and power forges and manipulation of the fire, with progressive exercises in iron forging designed to teach the operations of drawing, upsetting, bending, forming and welding. The work of the second semester includes the forging and welding of mild and tool steels, as well as the hardening and tempering of simple hand tools. With mechanical drawing (a). I and II. ½ unit. T. Th., 8 to 10.

(c) **Forge Work.**—A continuation of (b) in forging and tempering hand tools, lathe tools, foundry tools, springs, drills and reamers, including annealing and case-hardening. With mechanical drawing (b). I. ¼ unit. F., 1 to 3. Sat., 8 to 10.

(d) **Foundry.**—A course in bench and floor moulding in green sand. Castings in white metal, brass and cast iron are poured for use in the machine shop. With mechanical darwing (b). I and II. ½ unit. I, T., 2 to 4; Sat., 10 to 12. II, F., 1 to 3; Sat., 10 to 12.

(e) **Pattern Making.**—Instruction in the methods of making proper allowances on patterns for draft, shrinkage and finish, and practice in the construction of patterns for pulleys, hangers, machine parts and pipe fittings, with the necessary core boxes. II. ¼ unit. T., 2 to 4; Sat., 8 to 10.

(f) **Machine Work.**—Bench work, including chipping, filing, scraping, fitting, soldering, brazing, and babbitting. Machine tool work on drill press, shaper, planer and lathe. II. ¼ unit.

(g) **Advanced Wood Work.**—Students electing this subject for the remainder of the course are given work preparing them to follow the trade of pattern-maker, cabinet-maker, or carpenter. I and II. ½ unit. T., 8 to 10; Sat., 10 to 12.

(h) **Machine Work.**—Students choosing this subject are given advanced work on lathe, milling machine and grinder, with practice in hardening and tempering taps, dies, cutters and high speed steels. I and II. ½ unit. T. Th., 8 to 10.

(i) **Advanced Woodwork.**—A continuation of (g). I and II. ½ unit. T., S to 10; Sat., 10 to 12.

(j) **Machine Work.**—A continuation of (h). I and II. ½ unit. T Th., 8 to 10.

(k) **Foundry.**—Advanced moulding, core making, brass furnace and cupola practice. I and II. ½ unit.

STEAM BOILERS AND ENGINES.

(a) **Steam Boilers and Practice.**—The construction and operation of steam boilers, and their auxiliaries, including the care of boilers, their strength and evaporative capacity, the physical properties of steam, combustion of fuel, pumps, injectors, feed water heaters, condensers. Prerequisites, physics, solid geometry, mechanical drawing (a), (b), and machine work (f). I. ½ unit. M. W. F., 9 to 10.

(b) **Steam and Gasoline Engines.**—The construction and operation of steam and gasoline engines; valves and valve gears, governors; lubricators; indicator cards, indicated horse power, brake horse power, efficiency; belts and pulleys. Prerequisite, steam boilers (a). II. ½ unit.

ELECTRICAL PRACTICE.

(a) **Electrical Practice.**—Elementary principles of electricity, electric wiring, management and care of electrical machines and apparatus, including dynamos and motors, batteries, electric lights, telephones and telegraph apparatus. Text book, Management of Electrical Machines, by Crocker and Wheeler. Prerequisites, Physics (a). Three lectures and recitations per week. I and II. ¾ unit.

REVIEWS.

Reviews.—In the scientific and home science courses a review of nine weeks is offered in arithmetic, geography, English grammar and civics. I and II. 1 unit. M. T. W. Th., 8 to 9.

Course in Household Economy

ONE YEAR.

This course is intended for young women who are not prepared to do college work but who wish systematic instruction in home science. Applicants must have completed the eighth grade in the common schools.

First Semester		Second Semester	
Physical Culture	1	Physical Culture	1
English (a)	4	English (a)	4
Sanitation (c)	2	Household Management (f)	2
Sewing (e)	5	Sewing (e)	4
Art	2	Home Decoration	1
Cooking (e)	5	The House (d)	2
		Cooking (e)	2
		Handicraft	2
	19		18

NOTE.—See Preparatory School for sub-courses in English, Sanitation and Household Management.

(e) Cooking—The object of the course is to teach plain cooking breads, meats, eggs, cereals, soups, salads, preserving fruits, cakes, candy and simple desserts. Some attention is given to invalid cookery. Visits to the meat market to study cuts of meat. Attention is given to table setting and serving meals. Each student gives one demonstration lesson. The work is theoretical as well as practical. The students are shown how biology and chemistry apply to the preparation of foods. Williams and Fisher's text book, "The Elements of the Theory and Practice of Cookery" is used. I, T. Th. F., 9 to 11; II, M. W., 10 to 12.

(e) Sewing—The fundamental principles of hand and machine sewing, applied to aprons and undergarments, are given in the first semester. In the second semester, designing and making waists and simple dresses. A wool dress and a dress for afternoon wear are part of the work. I and II. 9. I, M. T. W. Th. F., 2 to 4. II, T., 8 to 10; Th., 2 to 4.

(d) The House—A study of the evolution of the house; the surroundings, situation and plan of the house, heating, lighting, plumbing and drainage. Lectures on house furnishings, exercises in making skeleton plans of small houses. The text book used is The House, by Miss Bevier. I, 2. M. W., 11 to 12.

School of Agriculture

H. F. Patterson, Principal.

The School of Agriculture trains men to take charge of the farms. This course is planned to provide instruction in agriculture during the winter months. It is primarily adapted to fit men for practical farm management. It is a technical training, minus a large part of the science work. No young man who intends to run the home farm should be without such a course.

Time.—This course includes six terms of three months' each, extending through the winters of three years. The first term this year begins October 10, 1911 and ends just before Christmas. The second term opens January 3, 1912, and continues for three months. Students may enter at the beginning of any term.

Entrance Requirements.—Any person who is either over 21 years of age or has completed the 8th grade work in the public schools is eligible for this course. No entrance examinations are required.

Cost.—The tuition or the School of Agriculture is free. A general fee of $6.00 per year is charged and there is also a small fee for some of the laboratories. The laboratory fee for dairying and chemistry is $2.00 each; the laboratory fee in biology is $1.00; in shop work, $4.00 per year. These laboratory fees are for the purpose of practically covering the breakages that occur.

Board and room in Bozeman will cost from $4.00 to $6.00 per week, and the cost of the entire six months need not exceed $150.00.

Equipment.—The Agricultural College affords excellent opportunity for carrying on the work. Each department is well equipped. The animal industry department is well supplied with all of the important breeds of live stock. Each animal is a fair representative of its breed. The agronomy department is equipped to give practical work with grains and soils. Nearly all of the courses are supplemented with practical applied work.

Below is given an outline of the course as offered in the School of Agriculture:

COURSE IN SCHOOL OF AGRICULTURE.

FIRST YEAR.

First Semester.		Second Semester.	
English Composition (Eng. f)	2	English Composition (Eng. f)	2
Animal Types (An. Ind. a)	2	Animal Types (An. Ind. b)	2
Nursery Practice (Hort. a)	3	Botany (Biol. b)	4
Farm Dairy (An. Ind. f)	4	Vegetable Gardening (Hort. b)	3
Physics (Phys. b)	5	Chemistry (Chem. a)	5
Carpentry (Mech. Arts a)	4	Blacksmithing (Mech. Arts b)	4
	20		20

SECOND YEAR.

Rhetoric (Eng. g)	2	Breed Types (An. Ind. d)	3
Breed Types (An. Ind. c)	3	Irrigation and Drainage (Agron. g)	2
Orcharding (Hort. c)	3	Insects (Biol. d)	4
Plant Diseases (Biol. c)	4	Poultry (An. Ind. e)	5
Farm Mechanics (Agron. f)	4	Field Crops (Agron. b)	4
Field Crops (Agron. a)	4		
	20		20

THIRD YEAR.

English Literature (Eng. h)	2	English Literature (Eng. h)	2
Feeding and Management of Live Stock (An. Ind. g)	3	Feeding and Management of Live Stock (An. Ind. h)	3
Landscape Gardening (Hort. c)	3	Advanced Dairying (An. Ind. j)	3
Soil Physics (Agron. c)	3	Soil Fertility (Agron. d)	3
Principles of Breeding (An. Ind. i)	3	Farm Management (Agron. e)	3
Common Diseases (Vet. Sci. a)	3	Common Diseases (Vet. Sci. a)	3
Advanced Grain Judging (Agr. b)	2	Agricultural Economics (Econ. a)	2
	19		19

AGRONOMY.

(a) **Field Crops.**—This course includes a study of the methods of growing and producing oats, wheat, flax, rye and corn. First semester, second year; 4 credits; 3 lectures, 1 laboratory. Prerequisites Biology (c).

(b) **Field Crops.**—This includes a study of all forage crops and grasses. Second semester, second year; 4 credits; 3 lectures and 1 laboratory. Prerequisites Biology (c) and Agron. (a).

(c). **Soil Physics.**—A review of the study of the formation of soils and a study of the methods of maintaining the physical condition of the soil. First semester, third year; 3 credits; 3 lectures. Prerequisites Physics, Chemistry and Agronomy (b).

(d) **Soil Fertility.**—Soil fertility includes a study of the methods of maintaining the fertility of the soil in this state, as well as a study of the different methods of handling the farm yard manure and the rotation of crops. Second semester, third year; 3 credits. Prerequisites Soil Physics, Chemistry and Agronomy (b).

(e) **Farm Management.**—In this course students are taught the practical methods of managing a farm. Second semester, third year; 3 credits. Prerequisites Soil Physics and Soil Fertility.

(f) **Farm Mechanics.**—This course includes a study of farm mechanics, farm motors and farm buildings. 4 credits; first semester, second year; 3 lectures, 1 laboratory. Prerequisite Physics.

(g) **Irrigation and Drainage.**—Includes a study of the different methods of irrigating and draining the land. Second semester, second year; 2 credits per week. Prerequisites Physics or Agronomy (f).

(h) **Advanced Grain Judging.**—In this course students are given practical work in judging the different grains. First semester, third year; 2 credits; 2 laboratories. Prerequisites Agronomy (a and b).

ANIMAL INDUSTRY.

(a) **Animal Types.**—A study of the market types of cattle and sheep. 2 credits; first semester, 1st year; 2 laboratories.

(b) **Animal Types.**—Judging of the market types of dairy cattle, horses and swine. Second semester, first year; 2 credits; all laboratory.

(c) **Breed Types.**—Includes a study of the breed types of cattle and sheep. First semester, second year; 3 credits; 1 lecture and two laboratories. Prerequisites Animal Industry (a or b).

(d) **Breed Types.**—Includes study of the breed types of dairy cattle, horses and swine. Second semester, second year; 3 credits; 2 laboratories and 1 lecture period. Prerequisite Animal Industry (a or b).

(e) **Poultry.**—This course includes a study of the breed types and the management of poultry. Second semester, second year. 5 credits; 3 lectures and 2 laboratories.

(f) **Farm Dairy.**—Includes a study of the methods of handling cream and butter upon the small dairy farm. First semester, first year; 4 credits; 2 lectures and 2 laboratories.

(g) **Feeding and Management of Live Stock.**—In this course the students receive instruction as to the different methods of feeding and managing cattle and sheep. They are also taught the different methods by which these animals are prepared for the show ring. First semester, third year; 3 credits; 1 lecture and 2 laboratories. Prerequisites Animal Industry (c and d).

(h) **Feeding and Management of Live Stock.**—A study of the methods of feeding, showing and managing of horses and hogs. Second semester, third year; 3 credits; 1 lecture and 2 laboratories. Prerequisites Animal Industry (c and d).

(i) **Principles of Breeding.**—This course includes a study of the principles of breeding as directly applied to the farm. Cross breeding, in-breeding and line breeding are taken up. First semester, third year; 3 lecture periods per week. Prerequisite Animal Industry (c and d).

(j) **Advanced Dairying.**—This course includes a study of the creamery methods of making butter and cheese. Second semester, third year; 3 credits; 2 laboratories and 1 lecture. Prequisites Animal Industry (f).

VETERINARY SCIENCE.

(a) **Common Diseases.**—The aim of this course is to first give the student lectures upon the physiology of the digestive, respiratory and blood vascular system in order to prepare him for a more comprehensive study of the common diseases. It also includes a study of various kinds of wounds and their treatment, general conformation and care of the teeth and some of the more common ailments in all species of domestic animals. During the second semester, lectures will be given on the care and handling of breeding animals, and accidents and diseases attendant upon parturition. 3 credits each semester, third year. Prerequisites Biology (c and d).

HORTICULTURE.

(a) **Nursery Practice.**—This study deals with the propagation of fruit and ornamental plants for both home and orchard purposes. First semester, first year; 3 lectures.

(b) **Vegetable Gardening.**—The study of the methods of growing vegetables, hot bed construction and management, and the different methods of gathering and marketing vegetables and fruits. Second semester, first year; 3 lectures.

(c) **Orcharding.**—Methods of growing and handling trees and small fruits are studied. First semester, second year; 3 lectures. Prerequisite Horticulture (a or b).

(d) **Landscape Gardening.**—In this course particular attention is given to the study of plants for laying out and mapping out farm homes, as well as a study of the different trees, shrubs and flowering plants that are suitable for Montana. First semester, third year; 3 lectures. Prerequisites Horticulture (a or b).

BIOLOGY.

(b) **Botany.**—The elements of botany are taken up, especially with a view to the needs of agricultural students. The classification, structure,

physiology and ecology of plants are briefly covered. Special attention is given to farm weeds. Second semester, first year; 4 credits; 3 lectures; 1 laboratory.

(c) **Plant Diseases.**—This course includes a study of the common diseases of the cultivated plants. First semester, second year; 4 credits; 2 lectures and 2 laboratories. Prerequisite Biology (b).

(d) **Insects.**—Includes a study of the insects that are troublesome to the Montana farmer. 3 lectures and 1 laboratory. Second semester, second year; 4 credits.

PHYSICS.

(b) **Elementary Physics.**—Includes experimental lectures, recitations and assigned problems on mechanics, heat, light and electricity. Emphasis will be placed upon those subjects that have direct bearing upon applied agriculture. First semester, first year; lectures.

CHEMISTRY.

(a) **Elementary Chemistry.**—Includes a study of the fundamental principles of chemistry and their relation to agriculture. Second semester, first year; five lectures.

MECHANIC ARTS.

(a)—**Carpentry.**—The use and care of carpentry tools. A series of exercises in joinery, followed by practice in framing, rafter and stair-cutting. First semester, first year; 4 credits; all laboratory work.

(b)—**Blacksmithing.**—Care and manipulation of the fire, iron forging, including the operations of drawing, upsetting, pointing, bending, welding, calculation of stock, implement repairs, plow pointing, manufacture of chains, hooks, clevises, clips, etc. Second semester, first year; 4 credits, all laboratory.

ENGLISH.

(f)—**English Composition.**—The first year is devoted largely to practice in the simpler forms of composition, letter writing, simple narrative and exposition; and considerable time is given to reading aloud, blackboard work and informal discussion with attention to correct speech. First and second semesters; 2 credits each semester.

(g)—**Rhetoric.**—During the second year more advanced work is given in composition, with frequent themes, reviews, etc. A few masterpieces are read as a basis for the careful study of good style. First and second semesters; 2 credits each semester.

(h)—**Literature.**—During this year a more systematic study of several authors is attempted. For the year 1911-12 the time was given to Irving, Hawthorne, Emerson and Longfellow. A considerable amount of writing in several different forms is required. First and second semester; 2 credits each semester.

AGRICULTURAL ECONOMICS.

(a)—**Agricultural Economics.**—A study of such rural problems as farmers' organizations, economics of machinery, transportation, markets, taxation, etc. Second semester; 2 credits.

Winter Courses

Horse School.—January 22 to 27, 1912. Lectures will be given on how to feed, improve and care for the horse. Special work will be given on the diseases of horses. There will also be some practical experience in horse judging.

Poultry School.—January 29 to February 3, 1912. The work will consist of lectures on types, breeds, housing, feeding, incubation, brooding, preparing poultry for market, and general care and management of poultry.

Four Weeks' Creamery Course.—February 5 to March 3, 1912. This course is adapted to fit men to take charge of creameries. The greatest portion of the students' time will be spent in the college creamery.

Housekeepers' One Week Course.—This course for women will be given Jan. 22 to Jan. 27, 1912. This will be regular instruction in cooking and sanitation, with special lectures on food principles and appropriate clothing. There will also be special lectures on household bacteriology, the fly; home decoration, landscape gardening; and on emergency treatment for accident and disease.

Alumni

Allen, Elbert, B. S., 1903; Attorney at Law, Livingston, Mont.

Alward, Mary L., B. S., 1908; Teacher in Pony Public Schools, Pony, Mont.

Baker, Harold E., B. E. E., 1907; Assistant Superintendent Butte Substation, Missouri River Power Co., Butte, Mont.

Barnard, Robert B., 1910; Westinghouse Electric Co., Pittsburg, Pa.

Benton, Ralph, B. S., 1906; Instructor in Entomology, College of Agriculture, University of California, and Assistant Entomologist in charge of Apiculture, California Experiment Station, Berkeley, Cal.

Bole, William S., B. S., 1906; Physician, Great Falls, Mont.

Blankenship, Hon. E. V., 1897; Yellowstone Park Transportation, Farming and Stock Raising, Bozeman, Mont.

Brewer, Lucile, B. S., 1909; Matron, Woman's Hall, Montana State University, Missoula, Mont.

Breneman, Annie T., B. S., Teacher in Eighth Grade, Bozeman, Mont.

Brown, Archie S., B. S., 1910; Electrical Engineer, Seattle Electric Co., Seattle, Wash.

Brown, Edith E., B. S., 1904; Mrs. John Milloy, Regina, Sask., Canada.

Bull, Edna, B. S., 1909; Instructor in Domestic Science, Bozeman Public Schools, Bozeman, Mont.

Bull, Frieda, B. S., 1907; M. S., 1909; Instructor in Mathematics, Montana Agricultural College.

Burke, Edmund, B. S., 1907; Chemist and Meteorologist of the Montana Agricultural Experiment Station, Bozeman, Mont.

Butler, Donald, B. S., 1909; Electrical Engineer, Washington Water Power Co., Spokane, Wash.

Caldwell, Thomas O., B. A. C., 1899; Leasing on Gold Reef and Maginnis Mine, Gilt Edge, Mont.

Carmichael, Effie, B. S., 1910; Instructor in Home Science in Public Schools, Lewiston, Mont.

Chaffee, C. Sarah, B. S., 1906; Instructor in Mathematics and History, Rathdrum High School, Rathdrum, Idaho.

Cockrill, Irvine, B. A. C., 1900; Osteopath Physician, Kirksville, Mo.

Collins, W. E., B. S., 1902; Trust Officer of State Savings Bank, Butte, Mont.

Cooke, Amy, B. S., 1908; Mrs. George Ambrose, Helena, Mont.

Cowan, Lewis, B. C. E., 1904; Irrigation Engineer, Bozeman, Mont.

Davidson, Mary E., B. S., 1910; Student in School of Music, Montana State College of Agriculture and Mechanic Arts, Bozeman, Mont.

DeMuth, David R., B. S., 1910; First Assistant Engineer, Hebgen Dam, Norris, Mont.

DeMuth, Maud S., B. S., 1907; Mrs. W. D. Tallman, Bozeman, Mont.

Driscoll, William J., B. S., 1908; Civil Engineer, Lawrence, Mass.

Edwards, Timothy, B. S., 1909; Draughtsman, N. P. Office, Livingston, Mont.

Fisher, Charles M., B. S., 1908; Electrical Engineer, Washington Water Power Co., Spokane, Wash.

Fisher, Helen, B. S., 1910; Bozeman, Mont.

Flager, Harold J., B. E. E., 1907; Electrical Engineer, Seattle Electric Co., Seattle, Wash.

Flager, Howard A., B. E. E., 1906; Real Estate Business, Red Lodge, Mont.

Flager, Ruth, B. S., 1910; Instructor in Sewing, Butte High School, Butte, Mont.

Flaherty, Charles David, B. C. E., 1904; Civil Engineer, firm of Sacket & Flaherty, Livingston, Mont.

Foster, Florence, B. S., 1896; Mrs. Burton Flemming, Iowa City, Iowa.

Fox, Hazel, B. S., 1910; Instructor in Latin and Mathematics, Elgin High School, Elgin, Ore.

Freeman, Beatrice, B. S., 1900; Mrs. Thomas S. Davis, Columbus, Mont.

Freeman, W. B., B. C. E., 1903; District Engineer U. S. Geological Survey in charge of Denver District of Water Resources Branch, Denver, Colo.

Gardiner, Henry C., B. S. A., 1903; Veterinarian and Agricultural Expert, Anaconda Copper Mining Co., Anaconda, Mont.

Gottschalk, Carl, B. S., 1909; M. S., 1910; Assistant in Chemistry, Bozeman, Mont.

Griffith, Warren J., B. E. E., 1907; Electrical Engineer, Washington Water Power Co., Spokane, Wash.

Ham, Frank W., B. S., 1903; M. S., 1905; Professor of Physics, Montana Agricultural College.

Hartman, June, B. S., 1910; Instructor in Music, Redfield, S. D.

Hartman, Lois K., B. S., 1907; Instructor in Domestic Science, University of Utah, Salt Lake City, Utah.

Hartman, Will, B. S., 1908; Civil Engineer, Bozeman, Mont.

Hawkins, P. H., M. S., 1903; Banker, Absarokee, Mont.

Henderson, Charles F., B. S., 1910; Westinghouse Electric Co., Pittsburg, Pa.

Henderson, Lisle C., B. S., 1909; Switchboard Operator, Missouri River Power Co., Canyon Ferry, Mont.

Hinds, Bert S., B. S., 1909; Superintendent Power Plant, Madison River Power Co., Norris, Mont.

Hutton, Fred, B. E. E., 1902; deceased.

Jacobs, Lillian, B. S., 1910; Columbus, Mont.

James, John S., B. S., 1909; Civil Engineer, Cascade, Mont.

Jones, Burle J., B. S., 1904; Manager Orangewood Nursery Co., Phoenix, Ariz.

Jones, Wyatt Wagner, B. S., 1901; M. S., 1902; Plant Pathologist, Mammoth Copper Mining Co., Redding, Ca.

Kennedy, Cyril C., Electrical Engineer with Madison River Power Co., Norris, Mont.

Kimpton, Addie, B. S., 1910; Radersburg, Mont.

King, Lowell R., B. S., 1904; Assistant Engineer, B. & B. Dept., C., M. & P. S. Ry., Malden, Wash.

King, Ruby E., B. S., 1909; Mrs. George Hogan, Bozeman, Mont.

Kinney, Edward D., B. C. E., 1907; Manager Old Conley and McTague Ranch, Deer Lodge, Mont.

Kirk, Mary E., B. S., 1906; Teacher, Bozeman, Montana.

Kirscher, W. Guy, B. S., 1909; County Surveyor, Broadwater Co., Townsend, Mont.

Koch, Elers, B. S., 1901; Forest Supervisor, U. S. Forest Service, Missoula, Mont.

Kremer, William J., B. S., 1910; Agent U. S. Census of Irrigation, Helena, Mont.

Lamme, Maurice A., B. S., 1903; Instructor in Mineralogy, Columbia University, New York City, N. Y.

Lewis, Edna, B. S., 1903; Instructor in Mathematics, Gallatin County High School, and Member County Board of Examiners, Bozeman, Mont.

Livingston, Walter, B. S., 1910; Civil Engineer, Bozeman, Mont.

Locke, Jerome G., B. C. E., 1908; C. E., 1910; Special Agent in Charge U. S. Census of Irrigation, Montana and North Dakota, Helena, Mont.

Lorentz, Floyd S., B. E. E., 1907; E. E., 1910; Electrical Engineer United Missouri River Power Co., Keating Gold Mining Co., Radersburg, Mont.

Maynard, Edna, B. S., 1900; M. S., 1903; Mrs. G. T. Morris, Bozeman, Mont.

Monforton, Zoe, B. S., 1901; Mrs. Dr. H. C. Patterson, Bozeman, Mont.

Moore, Ellie J., B. S., 1901; Insurance Solicitor, Missoula, Mont.

Morgan, O. P., B. S., 1896; Farmer, Logan, Montana.

Morris, Elwood, B. S., 1909; Assistant in Botany, Montana Experiment Station, Bozeman, Montana.

Morris, Garfield T., B. C. E., 1903; Civil Engineer, Bozeman, Mont.

Mountjoy, Agnes, B. S., 1907; Teacher, Silver Star, Mont.

Mountjoy, Irvin, B. E. E., 1908; Traveling Salesman, General Electric Co., Chicago, Ill.

Nash, Lewis, B. S., 1904; Farmer, Hardin, Mont.

Noble, Erma, B. S., 1909; M. S., 1910; Teacher, Radersburg, Mont.

Osborne, Belle, B. S., 1907; Mrs. D. E. Fish, Adel, Iowa.

Pease, Jay L., B. C. E., 1907; Montana Representative of the Portland and Seattle Construction Co., Bozeman, Mont.

Penwell, Clyde C., B. S., 1906; B. E. E., 1907; Electrical Apprentice, Wilkinsburg, Pa.

Penwell, Clyde W., B. E. E., 1909; Manager Independent Telephone Co., Larned, Kan.

Peters, Orville S., B. S., 1909; Laboratory Assistant, Bureau of Standards, Washington, D. C.

Peterson, James A., B. S., 1909; Law Student, University of Minnesota, Minneapolis, Minn.

Pool, Louis K., B. S., 1910; City Engineer, Polson, Mont.

Potter, Ermine L., B. S., 1903; Instructor in Animal Husbandry, Oregon Agricultural College, Corvallis, Oregon.

Quaw, Lucile, B. S., 1903; Bookkeeper, Thos. B. Quaw & Co., Bozeman, Mont.

Quaw, Mignon, B. S., 1902; Graduate Student, Columbia University, New York City.

Quaw, Thomas B., 1907; Business, Bozeman, Mont.

Reese, Herbert J., B. S., 1904; Agent, Butte and Superior Copper Co., Bartlesville, Okla.

Robinson, J. W., B. S., 1908; With Benepe-Berglund Grain Co., Manhattan, Mont.

Sacket, Charles T., B. C. E., 1904; C. E., 1907; City Engineer, Livingston, County Surveyor, Park County; Major, Corps of Engineers, Montana National Guards, Livingston, Mont.

Sales, Reno H., B. S., 1898; Geologist Anaconda Copper Co., Butte, Mont.

Schabarker, W. W., B. M. E., 1902; Night Foreman, Shops, Milwaukee R. R., Milwaukee, Wis.

Schmidt, F. W., B. S., 1903; Superintendent Cyanide Plant, Brazil, S. A.

Shaw, W. T., B. S., 1896.

Sloan, J. H., B. C. E., 1903; Civil Engineer, Bozeman, Mont.

Sloan, W. F., B. E. E., 1903; Expert Investigation Office, Committee on Gas, Oil and Electric Light, City Council of Chicago.

Sloan, William Glen, B. S., 1910; Civil Engineer, Polson, Mont.

Spain, W. Whitfield, B. S., 1909; Manager Ranch, Bozeman, Mont.

Spragg, Frank A., B. S. A., 1902; Plant Breeder of Farm Crops for the Michigan Experiment Station, Lansing, Mich.

Stafford, Lucy B., B. S., 1896; Mrs. Wm. Otis Peck, Pony, Mont.

Tavener, Frank C., B. C. E., 1903; Manager Telluride Construction Co., Salt Lake City, Utah.

Thompson, Homer C., B. S., 1902; Superintendent of Public Schools, Chouteau, Mont.

Thorpe, Mabel A., B. S., 1907; Mrs. J. A. Thaler, Bozeman, Mont.

Thorpe, Elizabeth, B. S., 1907; Teacher in Public Schools, Nephi, Utah.

Tracy, Edna B., B. S., 1908; Instructor in Virginia City High School, Virginia City, Mont.

Vreeland, Edna, B. S., 1909; Cafetaria Manager and Domestic Science Instructor Y. W. C. A., Spokane, Wash.

Walchli, Fred E., B. S., 1910; Night Engineer and Fireman, Somers, Mont.

Widener, Carl C., B. S., 1908; City Engineer, Bozeman, Mont.

Williams, Frank B., B. M. E., 1899; Mill Foreman, Apex Co., Virginia City, Mont.

Williams, Lee, B. E. E., 1902; County Surveyor, Powell County and City Engineer, Deer Lodge, Mont.
Wilson, Elva A., B. S., 1909; Teacher, Bozeman Public Schools.
Wylie, Mary, B. S., 1910; Y. W. C. A., Secretary, Portland, Oregon.

PHARMACY DEPARTMENT ALUMNI.

Allen, Edgar Warren, Ph. C., 1910; Red Lodge Drug Co., (Joint Proprietor.)
Conard, Blanche, Ph. C., 1910; Gallatin Drug Co., Bozeman, Mont.
Cox, Harvey H., Ph. C., 1910; Gallatin Drug Co., Bozeman, Mont.
Drinville, James, Ph. C., 1910; Fuller Drug Co., Havre, Mont.
Mitchell, Paul L., Ph. C., 1909; Phillips Drug Co., Lewistown, Mont.
Valentine, Charles P., Ph. C., 1910; Lapeyre Bros., Great Falls, Mont.
Young, Earl, Ph. C., 1910; J. A. Turner, Huntley, Mont.

SCHOOL OF MUSIC GRADUATES.

Alward, Coda, Piano, 1908.....Polson
Benge, Faith, Piano, 1910.....Winterset, Iowa
Brown, Edith, Piano, 1906, Mrs. John Milloy.....Regina, Canada
Featherston, Ellis, Piano, 1907, Music Supervisor.....Matteawan, N. Y.
Freeman, Lorraine, Piano, 1906, Student.....Berlin, Germany
Griffin, Grace, Piano, 1907, Mrs. W. C. Blythe.....Whittier, Cal.
Hartman, Flora, Piano, 1907, Teacher.....Everett, Wash.
Hartman, June, Piano, 1910, Teacher.....Redfield, S. D.
Lovelace, Amy, Vocal, 1908, Student.....New York City
Maynard, Frances, Piano, 1909, Mrs. Ed. Howard.....Bozeman
Piedalue, Alice, Piano, 1908, Mrs. C. W. Hancock.....Bozeman
Stanton, Grace, Piano, 1901, Mrs. W. B. Walker.....Glendive
Waters, Mary, Piano, 1902, Mrs. H. L. Houston, Teacher.....Bozeman
Widener, Carl, Vocal, 1908, Engineer.....Bozeman
Widener, Carl, Vocal, 1908, City Engineer.....Bozeman
Work, Vida, Piano, 1909, Teacher.....Bozeman

Degrees Granted June, 1910

GRADUATE DEGREES.

Gottschalck, Carl, M. S. Bozeman
Locke, Jerome G., C. E., ... Helena
Lorentz, Floyd S., E. E., ... Radersburg
Noble, Erma, M. S., ... Bozeman

BACHELOR OF SCIENCE.

Barnard, Robert B.	Electrical Engineering
Brown, Archie S.	Electrical Engineering
Carmichael, Effie	Home Science
Davidson, Mary E.	Home Science
De Muth, David R.	Civil Engineering
Fisher, Helen	Home Science
Flager, Ruth	Home Science
Fox, Hazel	Mathematics-Physics
Hartman, June	Mathematics-Physics
Henderson, Charles F.	Electrical Engineering
Kennedy, Cyril C.	Electrical Engineering
Kimpton, Addie	Home Science
Kremer, William J.	Civil Engineering
Jacobs, Lillian C.	History-Literature
Livingston, Walter T.	Civil Engineering
Pool, Louis K.	Civil Engineering
Sloan, William G.	Civil Engineering
Walchli, Fred E.	Mechanical Engineering
Wylie, Mary	Home Science

PHARMACEUTICAL CHEMIST.

Allen, Edgar W.	Red Lodge	Drinville, James	Havre
Conard, Blanche	Bozeman	Valentine, Charles P.	Great Falls
Cox, Harvey	Bozeman	Young, Earl	Huntley

SCHOOL OF MUSIC.

DIPLOMAS.

Benge, Faith	Piano	Winterset, Iowa
Hartman, June	Piano	Redfield, S. Dakota

Names of Students

1910-11.

SENIORS.

Annin, James T.	Agriculture	Columbus
Bancroft, Ray E.	Agriculture	Bozeman
Bell, James C.	Agriculture	Gilt Edge
Booker, Clinton T.	Electrical Engineering	Helena
Carr, Irene H.	Home Science	Bozeman
Clark, Ben A.	Civil Engin'g	Hunters' Hot Springs
Clark, Grace	Home Science	Belgrade
Edsall, William S.	Electrical Engineering	Bozeman
Ellis, Edward M.	Electrical Engineering	Maudlow
Froebe, Frank J.	Civil Engineering	Absarokee
Haines, Will T.	Electrical Engineering	Sheridan
Hamilton, Everett A.	Electrical Engineering	Belgrade
Higgins, Lucile	Mathematics-Physics	Townsend
King, Willard V.	Biology	Florence
Kirk, Grace	Home Science	Salesville
Metheny, Blanche	Home Science	Bozeman
Peck, Harry	Electrical Engineering	Garneill
Philpott, June	Mathematics-Physics	Bozeman
Piedalue, Irene	Home Science	Bozeman
Quaw, Eugene C.	History-Literature	Bozeman
Snider, Leta	Mathematics-Physics	Bozeman
Spain, J. Marvin	Agriculture	Bozeman
Tremper, William G.	Civil Engineering	Helena
Wade, Arthur M.	Electrical Engineering	Norris
Williams, Roy B.	Civil Engineering	Bozeman
Williams, Sidney A.	Electrical Engineering	Boulder

JUNIORS.

Baker, Florence	History-Literature	Bozeman
Blessing, John	Agriculture	Brownsville, Minn.
Chapman, William E.	Civil Engineering	Dillon
Cook, George H.	Agriculture	Como
Dahling, J. Hugo	Civil Engineering	Bozeman
Daley, Freeman A.	Civil Engineering	Chouteau
Donaldson, Noble C.	Agriculture	Helena
Draper, Charles H.	History-Literature	Red Lodge
Dusenberry, Inez M.	History-Literature	Bozeman
Edwards, Margaret	Home Science	Great Falls
Fisher, Wallace	Electrical Engineering	Bozeman
Hagerman, Edna	Home Science	Great Falls
Hansen, Charles L.	Agriculture	Dillon
Hinman, Ruth	History-Literature	Bozeman
Hodgkiss, J. Edward	Agriculture	Chouteau
Jones, Kyle	History-Literature	Chouteau
Lannin, Earl A.	Electrical Engineering	Butte
Lewis, Clara	Biology	Clara
Luther, J. Glen	Electrical Engineering	Chouteau
McGraw, John L.	Civil Engineering	Springfield, Mo.
Millegan, Guy J.	Agriculture	Millegan
Morgan, George W.	Agriculture	Bozeman
Morgan, Joe	Biology	Bozeman
Piedalue, Laura	Home Science	Bozeman
Pound, Sam H.	Civil Engineering	Big Timber

Shovell, William L.	Agriculture	Hamilton
Sacket, Nathalie	Civil Engineering	Bozeman
Sheriff, Court J. Jr.	Agriculture	Helena
Taylor, John C.	Agriculture	Chinook
Williams, Elmer J.	Electrical Engineering	Great Falls
Willson, Walter	Electrical Engineering	Bozeman
Wolpert, Harold E.	Civil Engineering	Boulder

SOPHOMORES.

Alderson, Myrtle	History-Literature	Helena
Anderson, Lee B.	Agriculture	Bozeman
Anderson, Ruth	Home Science	Bozeman
Anderson, Vera	Home Science	Bozeman
Bancroft, Clarke	History-Literature	Bozeman
Blinn, George W.	Agriculture	Butte
Bole, Margaret	Mathematics-Physics	Bozeman
Brabrook, Ralph S.	Civil Engineering	Atlanta, Ga.
Brook, Thomas B.	Mechanical Engineering	Bozeman
Buckley, Thomas W.	Civil Engineering	Manhattan
Chambers, Edwin A.	Agriculture	Philadelphia, Pa.
Clark, Olive	Home Science	Hunters' Hot Springs
Dahling, Louis F.	Civil Engineering	Bozeman
Dawes, Rhoda	Home Science	Bozeman
de Lacy, Walter	Agriculture	Helena
Douglas, Stanley	Electrical Engineering	Bozeman
Elske, Michael	Electrical Eng.	Carrington, N. D.
Fox, Walter M.	Electrical Engineering	Bozeman
Fraser, Charles L.	Civil Engineering	Columbus
Green, Jesse R.	Mechanical Engineering,	Manhattan
Griffith, Gilbert J.	Civil Engineering	Bozeman
Gordon, Fred E.	Agriculture	Forsyth
Hartman, Brooke	Mathematics-Physics	Bozeman
Hartman, Ruth	Home Science	Bozeman
Hill, Lewis	Mechanical Engineering,	Livingston
Hollier, Georgia	Home Science	Bozeman
Kirk, Cassius L.	Agriculture	Salesville
Kirk, Howard S.	Civil Engineering	Bozeman
Kruse, Jacob	History-Literature	Bozeman
Leinard, Ford B.	Agriculture	Bryan, Ohio
McGuire, J. Frank	Agriculture	Shannon
Martin, Claude A.	Civil Engineering	Stockett
McLean, Annis	Electrical Engineering	Bozeman
Morgan, Nan	Biology	Bozeman
Morris, Ernest	Chemistry	Virginia City
Powell, Hollis	Electrical Engineering	Livingston
Rubottom, Carter V.	Agriculture	Great Falls
Schumacher, Hettie	Home Science	Bozeman
Seamans, Arthur E.	Agriculture	Wauwatosa, Wis.
Smith, M. Alda	Home Science	Dillon
Soper, Joseph R.	Agriculture	Bozeman
Talmage, Earl C.	Electrical Engineering	Red Lodge
Truman, Joseph K.	Electrical Engineering	Bozeman
Wharton, John C.	Agriculture	Butte
Wight, Frank A.	Agriculture,	White Sulphur Springs
Willey, Leroy	Agriculture	Dillon
Wylie, Lawrence	Electrical Engineering	Bozeman

FRESHMEN.

Buford, Luther	Agriculture	Virginia City
Busch, Apollo G.	Electrical Engineering	Bozeman
Busse, Carl	Electrical Engineering	Great Falls
Campbell, D. Mead	Civil Engineering	Poplar
Clark, Roy	Agriculture	Chinook
Crouch, Leslie D.	Agriculture	Bozeman
Cullum, Georgia	Home Science	Helena
Davis, Horace S.	History-Literature	Bozeman
Eckels, Mildred	Home Science	Forsyth
Entorf, Paul	Agriculture	Belgrade
Fowler, Viola	History-Literature	Bozeman
Grimes, Walter	Civil Engineering	Bozeman
Heighton, Pearl	Home Science	Chouteau
Hammell, Vern	Agriculture	Minneapolis, Minn.
Harmon, Ella M.	Home Science	Helena
Hawley, Maud	Home Science	Chouteau
Higbie, David V.	Civil Engin'g,	Ridgefield Park, N. J.
Hodgskiss, William L.	Agriculture	Chouteau
Jones, Ray	Chemistry	Livingston
Kiefer, James	Mathematics-Physics	Bozeman
Knox, Howard	Electrical Engineering	Butte
Lewis, Albert L.	Agriculture	Clara
Lockhart, Harold B.	Agriculture	Helena
Millegan, Homer D.	Agriculture	Millegan
Olsen, Ella K.	Home Science	Silver Bow
Papke, William	Civil Engineering	Bozeman
Pool, Florence	Home Science	Townsend
Pool, Lucy	Home Science	Townsend
Shiell, Helen	History-Literature	Buffalo
Sloan, Mary	Home Science	Bozeman
Solberg, Selmer	Electrical Engineering	Big Timber
Spain, Roy	Agriculture	Bozeman
Stanton, Ruth	History-Literature	Helena
Switzer, Madge	Home Science	Bozeman
Truitt, Charles A.	Civil Engineering	Bozeman
Valleau, Vie	Home Science	Livingston
Vestal, William B. Jr.	Civil Engineering,	Indianapolis, Ind.
Ward, Rupert W.	Civil Engineering	Chouteau
Webster, Alden	Electrical Engineering	Bozeman
Whitworth, William J.	Electrical Engineering	Deer Lodge
Winter, William	Civil Engineering	Bozeman
Williams, George P.	Agriculture	Cedar Rapids, Iowa

IRREGULAR.

Armstrong, Edith	Art	Bozeman
Bromley, Merl	Art	Bozeman
Buell, Vera	Art	Bozeman
Cline, Eva	Art	Bozeman
Fisher, Viola	Art	Bozeman
Livingston, Mildred	Art	Bozeman
Peters, Cora	Home Science	Butte
Vreeland, Mrs. Pomeroy	Home Science	Bozeman
Wilson, Anna	Home Science	Bozeman

FOURTH PREPARATORY.

Allard, Peter	Scientific	Laurel
Breneman, Edith	Home Science	Bozeman
Distad, Amanda	Home Science	Bozeman
Heighton, Earl	Scientific	Chouteau
Kirby, Noah	Scientific	Gebo, Wyo.
Lewis, Albert	Scientific	Clara
Moore, Inez	Home Science	Bozeman
Nordquist, Joe	Mechanic Arts	Bozeman
Wilkins, Roy	Scientific	Laurel

THIRD PREPARATORY.

Bower, Edith	Home Science	Jeffers
Brook, Gladys	Home Science	Bozeman
Crouse, Lester	Mechanic Arts	Belgrade
Higgins, Patti	Home Science	Bozeman
Lorentz, Noyes	Mechanic Arts	Toston
McKee, Zora	Home Science	Jeffers
Potter, Charles L.	Mechanic Arts	Miles City
Roberson, Elizabeth	Scientific	Sixteen
Sexton, Earl	Mechanic Arts	Belgrade
Smith, Verne	Mechanic Arts	Great Falls
Urbach, Albert	Mechanic Arts	Livingston

SECOND PREPARATORY.

Allison, W. B.	Mechanic Arts	Cut Bank
Brinkman, Ruth	Scientific	Marias
Carter, Howard	Mechanic Arts	Livingston
Cook, Charles W.	Mechanic Arts	Roundup
Elliott, Mae	Home Science	Clara
Esp, Albert	Mechanic Arts	Big Timber
Esp, Tilmar	Mechanic Arts	Big Timber
Flint, Nelson	Mechanic Arts	Bozeman
Green, Dorothy	Home Science	Belgrade
Hacker, Ralph	Mechanic Arts	Somers
Henderson, Carl	Mechanic Arts	Chicago, Ill.
Jeffers, Lawrence	Mechanic Arts	Jeffers
Keene, Jesse	Scientific	Canton
Lindstrand, Florence	Home Science	Elso
Milam, Stanley	Mechanic Arts	Augusta
Monson, William	Mechanic Arts	Ovando
Officer, Guy	Scientific	Hunters' Hot Springs
Weldy, Marguerite	Home Science	Chester
White, Sylvanus	Mechanic Arts	Augusta

FIRST PREPARATORY.

Blanchard, Mac	Mechanic Arts	Bozeman
Callaway, Steven	Mechanic Arts	Park City
Distad, Raymond	Scientific	Bozeman
Dubois, Arthur	Scientific	Livingston
Disbrow, Beulah	Home Science	Polson
Finlay, William	Scientific	Bozeman
Ford, Albert	Scientific	Belgrade
Gerber, Elsie	Home Science	Sand Coulee
Hacker, Glenn	Mechanic Arts	Somers
McVey, Pauline	Home Science	Belgrade
McMahon, Arthur	Scientific	Big Elk

Judd, Gerald	Mechanic Arts	Great Falls
Jackson, Claude	Mechanic Arts	Bozeman
Lewis, Thomas	Mechanic Arts	Great Falls
Pierce, Thomas	Scientific	Bozeman
Pink, William	Mechanic Arts	Silver Star
Roberts, Harvey	Mechanic Arts	Missoula
Wight, Charles	Mech. Arts	White Sulphur Springs
Wells, Thomas	Mechanic Arts	Great Falls

IRREGULARS.

Bidwell, Hugh	Mechanic Arts	Palmyra, Mo.
Ellis, Joseph	Mechanic Arts	Belgrade
Ervin, James K.	Mechanic Arts	Bozeman
Ellingsen, Cornwall D.	Art	Belgrade
Ellingsen, E. O.	Mechanic Arts	Belgrade
Jones, W. J.		Marshalltown, Iowa
Kishi, Akhiri		Bozeman
Klaver, Tunis	Mechanic Arts	Manhattan
Sheridan, Charles		Bozeman
Torrence, Carl H.	Mechanic Arts	Reading, Kansas

ONE YEAR HOME SCIENCE.

Baker, Bessie B.	Josephine	Nelson, Gussie	Livingston
Barton, Mabel	Bozeman	Hamilton, Erlice	Belgrade
Border, Mary	Bozeman	Peters, Ruth	Butte
Border, Thirza	Bozeman	Smith, Helen	Bozeman
Borthwick, Alberta	Hamar, N. D.	Schaeffer, Edith	Bozeman
Curtis, Ouida	Manhattan	Wells, Sarah	Craig
Caldwell, Beulah	Moore		

SCHOOL OF PHARMACY.

SECOND YEAR.

Crosby, Spencer J.,	White Sul. Spgs.	Wilson, Nicholas W.	Bozeman
McCarthy, Ray	Townsend	Woods, Richard J.,	Stanton, N. D.
Morris, Florence	Virginia City		

FIRST YEAR.

Converse, Earl W.	Anaconda	Stieb, Clyde W.	Hamilton
Burfiend, Henry C.	Dillon	Timmons, Joseph W.	Havre
Disbrow, Claude H.	Polson	Temple, Leslie C.	Radersburg

SCHOOL OF AGRICULTURE.

THIRD YEAR.

Peck, John W.	Garneill

SECOND YEAR.

Bradshaw, J. Riley	Helena	Kyle, Charles L.	Cardwell
Bevans, John T.	Helena	Metier, Earl	Belgrade
Clement, Robert F.	Flatwillow	Schurch, Walter E.	Deer Lodge
Degenhart, Christopher	Philipsburg	Seidensticker, John	Twin Bridges
Duffield, William A.	Joliet	Timmons, John M,	Havre

FIRST YEAR.

Clark, Bryan	Victor	McVey, Ward	Bozeman
Cline, Victor	Bozeman	Murray, John A.	Philbrook
Daley, Elmer O.	Chouteau	Murray, Henry T.	Philbrook
DeAtley, Rex B.	Clyde Park	Peterson, Frank	Absarokee
DeAtley, Gail	Clyde Park	Rostad, Louis R.	Howie
Gordon, Bryant	Belgrade	Sumner, Fred C.	Clyde Park
Gray, Robert K.	Great Falls	Tietjen, Fred D.	Great Falls
Haight, Thomas H.	Great Falls	Willis, Willard P.	Plains
Kaiser, John W.	Philipsburg		

IRREGULAR.

Campbell, Archie	Sixteen	Gunn, Reuben	Bozeman
Dawson, Fred	Stevensville	Reid, Ralph M.	Cleveland, Ohio
Forbis, Clarence J.	Missoula	van den Dries, Roger	Manhattan

SCHOOL OF MUSIC.

Accola, Estella	Piano	Bozeman
Accola, Grace	Piano	Bozeman
Anderson, Vera	Harmony	Bozeman
Armstrong, Edith	Piano	Bozeman
Baker, Florence	Piano	Bozeman
Baker, Lulu	Voice	Bozeman
Bancroft, Alma	Piano, Harmony	Bozeman
Bancroft, Ray	Voice	Bozeman
Barton, Mabel	Piano	Bozeman
Beck, Elsie	Piano	Bozeman
Borthwick, Alberta	Piano	Hamar, N. D.
Bromley, Mary	Piano	Bozeman
Buell, Vera	Piano	Bozeman
Caldwell, Beulah	Piano	Moore
Catron, Pearl	Piano	Bozeman
Clark, Grace	Voice	Bozeman
Cleveland, Grace	Piano, Harmony	Bozeman
Cline, Eva	Piano	Bozeman
Cook, George	Voice	Como
Currier, A. H.	Piano	Bozeman
Davidson, Mary	Piano, Harmony	Bozeman
Elliott, Mae	Piano	Lavina
Fisher, Wallace	Voice	Bozeman
Forrest, Daisy	Voice	Bozeman
Fransham, Edna	Piano	Bozeman
Fransham, Eugene	Piano	Bozeman
Gerber, Elsie	Piano	Sand Coulee
Hagerman, Edna	Voice	Great Falls
Hamilton, Erlice	Piano	Bozeman
Hartman, Brooke	Piano, Harmony	Bozeman
Hartman, Ruth	Piano, Harmony	Bozeman
Hartman, Leah	Piano	Bozeman
Harris, Vera	Piano	Bozeman
Heath, Valeria	Piano	Gardiner
Hollier, Georgia	Piano, Harmony	Bozeman
Kirk, Howard	Voice	Bozeman
Kirschner, Hortense	Piano	Bozeman
Kountz, Josephine	Piano	Bozeman
Lewis, Everett	Piano	Bozeman
Lindstrand, Florence	Piano	Roundup
Martin, Etha	Piano	Bozeman
Martin, Genevieve	Piano	Bozeman

Millegan, Guy	Voice	Millegan
Moore, Eleanor	Piano	Bozeman
Moore, Emma	Voice	Bozeman
Moore, Hazel	Piano	Big Timber
Morgan, George	Voice	Bozeman
Nelson, Gussie	Piano	Livingston
Nichols, Grace	Piano, Harmony	Bozeman
Park, John H.	Voice	Bozeman
Philpott, June	Piano	Bozeman
Piedalue, Laura	Piano	Bozeman
Quaw, Eugene	Piano	Bozeman
Reeve, E. E.	Voice	Bozeman
Roecher, Chester	Piano	Bozeman
Sales, Zada	Piano, Harmony	Bozeman
Schumacher, Hettie	Piano, Harmony	Bozeman
Settle, Ruby	Piano	Bozeman
Settle, Ruth	Piano	Bozeman
Shiell, Helen	Voice	Buffalo
Shovell, William	Voice	Hamilton
Smith, Erma	Piano, Harmony	Bozeman
Smith, Mrs. D. D.	Piano, Voice	Bozeman
Snider, Leta	Piano	Bozeman
Stanton, Ruth	Piano	Helena
Valleau, Vie	Piano, Voice, Harmony	Livingston
Van Camp, Mary	Piano	Bozeman
Wells, Sarah	Piano	Craig
White, Earl	Piano	Bozeman
Wilson, Anna	Voice	Bozeman
Wilson, Katherine	Voice	Bozeman

CREAMERY COURSE.

Bloch, E. G.	Rudyard	Laurie, Robert	Manhattan
Brown, William	Chewelah, Wash.	McCrae, Samuel	Chouteau
Bussard, A. G.	Brookfield, Mo.	Milam, Stanley	Augusta
Doerr, J. H.	Helena	Roth, B. F.	Bozeman
Jacobs, Ben	Ronan	Thomas, Thomas	Great Falls
Johnson, Albert	Chinook	Walker, W. R.	Miles City

POULTRY SCHOOL.

Alcorn, J. W.	Bozeman	Platt, Stella	Bozeman
Altenbrand, Mrs. Henry	Manhattan	Platt, Mrs. Edwin	Bozeman
Altenbrand, Henry	Manhattan	Sudduth, Margaret A.	Broadview
Bushnell, Howard C.	Toston	Sowry, Arthur	Butte
Brewer, Mrs. W. F.	Bozeman	Summers, Hrs. H. L.	Bozeman
Doerr, J. H.	Helena	Skalitzky, Elizabeth	Bozeman
Holloway, A. J.	Bozeman	Thorp, L. S.	Bozeman
House, W. H.	Bozeman	Thomas, Thomas	Great Falls
Jacobs, Ben	Ronan	Tucker, Lester	Bozeman
King, George L.	Bozeman	Walker, W. R.	Miles City
Myers, Mrs. O. E.	Bozeman	Webster, F. S.	Shawmut
McCann, Lulu	Salesville		

HORSE SCHOOL.

Aely, L. W.	Lewiston	Jacobs, Ben	Ronan
Albers, John	Dillon	Jackson, Claude	Bozeman
Anceny, Charles	Salesville	Johnson, Raymond	Sedan
Armstrong, George M.	Meyersburg	Kent, Bert	Bozeman
Berg, Oscar	Lennep	Kent, Earl	Bozeman
Berg, Oswald	Lennep	Kirk, Harris	Salesville
Berger, Charles	Bozeman	Kraft, Walter	Bozeman
Bloch, E. G.	Bozeman	Lewis, G. M.	Manhattan
Boddy, E. F.	Bozeman	Maynard, E. A.	Jeffers
Boddy, G. F.	Bozeman	Meserve, C. P.	Bozeman
Boddy, Ed.	Bozeman	Monforton, Remi	Salesville
Briggs, L. S.	Bozeman	Murry, W. H.	Bozeman
Cole, William	Rock Creek	McAllister, Allen	Bozeman
Corbin, O. D.	Bozeman	McAllister, Floyd	Bozeman
Cordry, J. E.	Bozeman	McDonnel, William	Bozeman
De Atley, W. H.	Clyde Park	McDonnell, William L.	Bozeman
Decker, William	Belgrade	McGuire, J. J.	Belgrade
Dusenberry, B. L.	Bozeman	McIlvaine, T. G.	Bozeman
Dusenberry, V. F.	Bozeman	McMann, John	Butte
Devore, J. N.	Bozeman	McMurdo, A. K.	Shields
Devore, O. L.	Bozeman	McQuillan, Jim	Bozeman
Ellingsen, C. D.	Belgrade	Piedalue, Hector	Imperial, Neb.
Ellingsen, E. O.	Central Park	Plott, Seth	Bozeman
Elson, D. C.	Trident	Reber, Edward A.	Manhattan
Ervin, W.	Bozeman	Sandquist, Arthur L.	Belgrade
Enoch, J. C.	Clyde Park	Sexton, Ray	Bozeman
Ford, George H.	Bozeman	Smith, Kirk	Livingston
Foster, J. H.	Bozeman	Snell, A. M.	Bozeman
Fox, H. F.	Sedan	Spurgeon, J. F.	Buffalo
Galbraith, D. T.	Bozeman	Spurgeon, K. C.	Straw
Gallop, J. H.	Coty	Sowder, James	Belgrade
Garner, Oscar	Manhattan	Stillman, A. Z.	Salesville
Greene, Jesse	Manhattan	Summers, Harry L.	Bozeman
Greene, J. H.	Belgrade	Thomas, T. C.	Canton
Grounds, J. M.	Manhattan	Thomas, Thomas	Great Falls
Gustin, D. C.	Kalispell	Thompson, E. A.	Bozeman
Haley, J. P.	Bozeman	Trzeinski, C. E.	Miles City
Haley, John R.	Bozeman	Tucker, Lester	Bozeman
Hammond, Bert	Forsyth	Umbarger, Wesley	Manhattan
Hannah, E. G.	Bozeman	Veo, Fred O.	Bozeman
Harding, Harry	Bozeman	West, I. J.	Big Timber
Harrer, Henry	Belgrade	Williams, J. B.	Manhattan
Harwood, W. A.	Willow Creek	Williams, J. C.	Bozeman
Henness, Asa	Sedan	Wilson, S. F.	Shields
Holloway, A. J.	Bozeman		

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